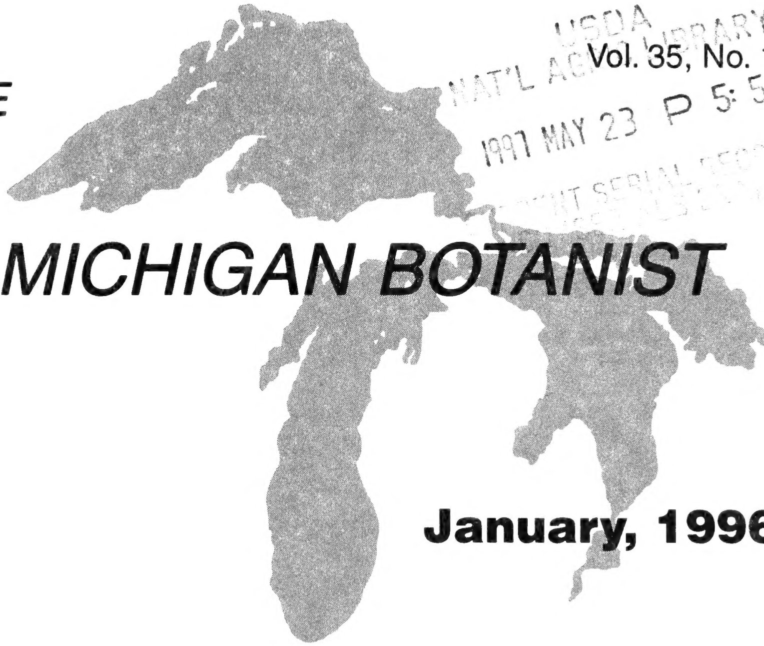

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THE FLORA OF CARIBOU ISLAND, LAKE SUPERIOR

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ABSTRACT

Caribou Island is a remote Canadian island in the upper Great Lakes of North America. Its flora is relatively small with 223 species of vascular plants, of which 16 are not native to North America. The island is composed of a series of postglacial sand dunes formed in a reef of Precambrian rock. A dense scrubby boreal type of forest covers much of the island with extensive bogs between the dunes. Significant floristic features include an unusual dune system with *Empetrum nigrum* and *Hudsonia tomentosa* as major binding species. Rare and restricted species on the island include *Potamogeton confervoides*, *Thalictrum revolutum*, *Vaccinium membranaceum*, and *V. ovalifolium*. Because of its remoteness and near absence of human disturbance the island provides a valuable opportunity for biogeographic and ecological research.

The topography and plant communities of the island are described, the flora listed, and its biogeography discussed in relation to climate and the postglacial history of the region.

Key Words: Great Lakes, Caribou Island, flora, island biogeography, conservation

INTRODUCTION

Caribou Island is the most remote island in the Great Lakes of North America. It lies in Lake Superior (Fig. 1) on the Canadian side of the international

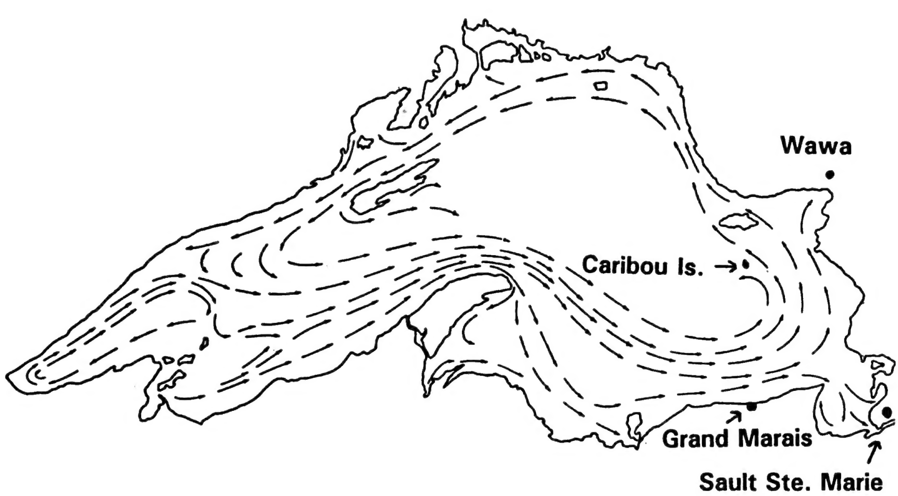

FIGURE 1. Lake Superior, surface currents (from Hough 1958 after Harrington), and the location of Caribou Island.

boundary, 68 km (42 mi) from the nearest part of the continental mainland in Canada and 77 km (48 mi) in the United States. The nearest land is Michipicoton Island, 34 km (23.5 mi) to the north.

We visited the island in August 1976 with the objective of surveying the vascular plant flora. The visit was arranged with the cooperation of the then owner, the late Captain Roys A. Ellis Jr., and the assistance of Mr. F.L. DeGrasse of the Canadian Hydrographic Service. We arrived on the island on August 19th, on a fishing boat sailing out of Mamainse Harbour. We went ashore on the east side of the island where we set up camp in a sheltered hollow on the dunes. We were flown off the island by a Canadian Coast Guard helicopter on August 29th. Though we were on the island for less than two weeks the visit coincided with the main flowering and fruiting seasons. The growing season on the island is very short, and spring is late to arrive because of the cold waters of Lake Superior. Also winter starts early, a reality that was apparent to us the day after our departure from the island when there was a killing frost on the north shore of Lake Superior.

TOPOGRAPHY

Caribou Island (Fig. 2) is about 4 km (2.5 mi) long and 2.5 km (1.5 mi) wide with an area of 615 hectares (1520 acres). It is a low island consisting of a series of sand dunes which rise to a height of 18 m (60 ft) above lake level and mostly lie in a north to south orientation. The island has formed on a reef of red sandstone which was planed off by the ice during the glacial period and subsequently eroded by waves and winter ice to a little below present lake level. Small areas of this bedrock are exposed on the west coast and on adjacent Gull Island. The reef is visible below the surface of the lake in several places offshore. Tests done during World War II, when the island was being considered for use as an emergency airfield, indicated that bedrock lies about 18 m (60 ft) below the surface in the interior of the island—i.e. at about lake level. The dunes in the interior of the island are stabilized by a dense growth of forest consisting mainly of fir, spruce, trembling aspen, and paper birch. During the development of the dune system lagoons were formed which have become shallow lakes, bogs and, in a few areas, sedge or leatherleaf meadows. Beaver dams have further impeded the drainage of the interior of the island, raising the level of several of the inland lakes to above that of the surrounding waters of Lake Superior and creating new lakes and ponds. The impeded drainage with the resultant lakes and bogs, together with the densely forested dunes, makes access to the interior of the island very difficult. Captain Ellis and his family had cut a trail from the east shore, where they had a cabin, to the middle of South Bay. This was invaluable in facilitating access to other parts of the island.

The island is more or less diamond-shaped with the northern end eroded into a narrow promontory with a small island (Gull Island) on the west side. A small area of bedrock is exposed here, and the area is composed of consolidated gravel and cobbles. The long shoreline on the eastern side of the island is bor-

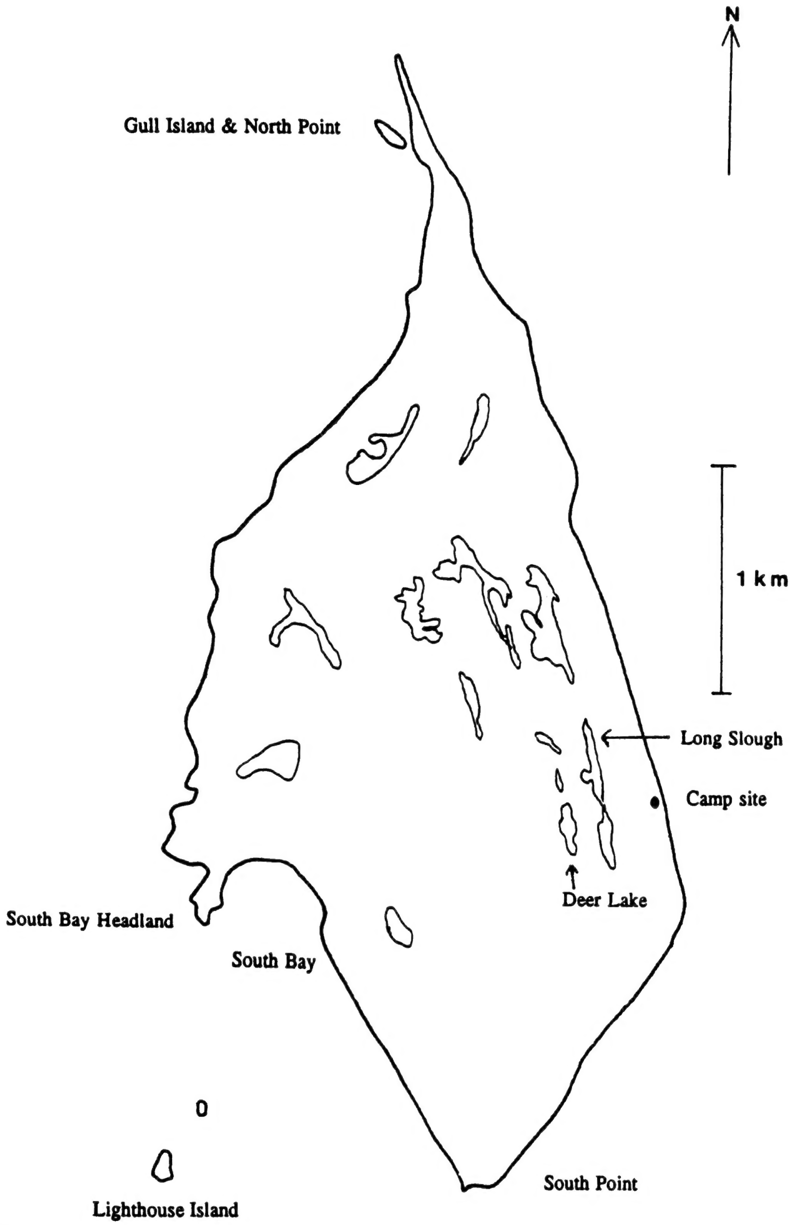

FIGURE 2. Named locations on Caribou Island. The names are ones used by Captain Ellis, the owner of the island in 1976.

dered by steep sand dunes with a narrow active zone between the lake and the densely forested interior. The western side of the island is subject to more erosion from lake currents, and small areas of bedrock are exposed. In several areas the low sand dunes are replaced by areas of gravel and cobble. The southwest shore of the island is more protected, with a beautiful shallow sandy bay (South Bay). Here the dunes are more extensive and well developed. South Bay is protected on the west side by a promontory (South Bay Headland) of cobbles and gravel. This is covered with a dense growth of mountain ash, birch, and alder. Behind South Bay Headland and dunes there is an area of fen which gives way to a drier meadow of leatherleaf (*Chamaedaphne*). The reef on which Caribou Island was formed extends southwards under the lake, and on it, about 1 km south of South Bay Headland, are two small islands. These are little more than gravel banks, but on the larger of the two Caribou Island lighthouse is situated.

GEOLOGY

The island has formed on a reef of pre-Cambrian rock which was eroded during the glacial period to about the present level of Lake Superior. The rocks in this part of the Lake Superior basin belong to the Upper Keweenawan series. These are of slightly metamorphosed conglomerates, sandstones, arkoses, and shales (Hough 1958). The small areas of bedrock which are visible around the shores of Caribou Island are of a dark red sandstone. The surface of the island is composed mainly of sand dunes. The rich color of the sand suggests that it was, at least in part, derived from the underlying reef by erosion resulting from lake ice. However, the occurrence of boulder clay at the north end of the island, and the bank of large cobbles and gravel which forms South Bay headland, indicate that glacial till covered at least part of the area when the glaciers finally receded from the island. Reworking of this by wave and wind action would produce much of the material from which the dunes have been formed. Gull Island and the nearby shore of Caribou Island are formed of consolidated boulder clay which is eroding into the lake, leaving cobbles and stones of which the northern spit of the island is composed. Similarly, parts of the west shore are composed of cobbles and gravel, as is the lighthouse island. These materials must have been derived from moraines and lacustrine deposits because, for the most part, they are not composed of the red sandstone which underlies the island.

POSTGLACIAL HISTORY OF THE REGION

The ice sheets of the Wisconsin glacial period receded to the north shore of Lake Superior about 9500 years ago. At that time the present rock threshold at Sault Ste. Marie, which now controls the level of Lake Superior, was covered by a moraine deposited by the retreating glaciers. This moraine eroded to its present level, exposing the threshold, by about 8000 years ago. Lake levels at this time (8000–7000 B.P.—the Houghton stage) were low and it is possible that

Caribou Island may have appeared above lake level, although uplift of the land which followed deglaciation may not have been sufficient for this to have occurred at that time. During the subsequent Nipissing transgression stage (ca. 7000–4000 years ago) the lake level rose, inundating the Sault Ste. Marie threshold, and Lake Superior became continuous with Lakes Huron and Michigan. Caribou Island emerged from this period of inundation only about 2200 years ago when the level of Lakes Huron and Michigan fell below the Sault threshold. Lake Superior then attained its present level of 194 m (602 ft) above sea level and Caribou Island came into being.

For a fuller account of the postglacial history of Lake Superior the reader is referred to Prest 1970, Karrow & Calkin 1985, and Saarnisto 1975. We are indebted to Réni Farvacque for useful discussions on this subject.

CLIMATE

Meteorological records for Caribou Island have been kept for many years at the lighthouse during the navigation season from May to November (Table 1). These records, together with those from the nearest weather stations on the mainland (Wawa, Sault Ste. Marie, and Grand Marais) are the basis for the following brief account of the climate of Caribou Island.

The climate of the island is greatly influenced by the surrounding waters of Lake Superior. The lake is the largest body of fresh water in the world with a surface area of 82260 sq km (31820 sq mi) (Hough 1958, Farrand & Drexler 1985) and a volume of over 12258 cu km (3000 cu mi). It acts as an enormous air conditioner and humidifier, cooling the surrounding air in the summer and ameliorating the intense cold of the winter. As a result Caribou Island has a cool but equable climate. The surface waters of Lake Superior in the vicinity of the island are at their warmest in early September, when they reach a mean daily temperature of 13°C (Irbe 1992). They function as a heat storage system into the winter months and by mid-December they are still at 4 to 5°C. The water temperature falls to a low of 0°C in February and early March. The surface temperature of the lake is slow to warm, and in mid-May the daily mean temperature is still less than 3°C. Even in early July it reaches only 5°C, but by the end of the month heat is being absorbed rapidly and the surface waters reach 7°C.

TABLE 1. The climate of Caribou Is. from records made at the lighthouse

Temperature in °C	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Daily Mean	—	5.3	7.7	11.5	14.1	11.6	6.8	1.7	—
Mean Daily Max.	—	8.0	10.7	14.6	16.4	13.6	8.7	3.8	—
Extreme Max.	15.5	22.8	20.5	25.6	25.6	24.5	27.8	12.8	8.9
Extreme Min.	–6.1	–4.4	–1.1	1.7	4.5	-0.6	–5.6	–18.0	–17.2
Precipitation in mm	—	64.7	68.7	66.6	78.3	75.3	68.7	65.8	—
Days with measurable ppt	—	10	11	10	12	13	15	13	—
Hrs. sunshine	—	239.4	227.5	250.3	242.8	160.7	117.6	46.8	—

Thus the cooling effect of the lake continues through the summer months and is the major factor in determining the cool climate experienced by the island. The effects of the lake on the climate of the island during the growing season can be seen from Table 2.

Maps of climatic conditions in the Great Lakes basin (Phillips & McCulloch 1972) provide a more complete indication of the climate of Caribou Island throughout the year. Table 2 is derived from these maps. It also gives comparative data from the weather stations nearest to Caribou Island on the shores of Lake Superior—Grand Marais, Wawa, and Sault Ste. Marie (additional sources: U.S. Dept. of Commerce 1974, Environment Canada 1975 & 1993). These and similar locations around the shore of the lake have a somewhat greater range of temperature than does the island because the effects of the lake interact with those of the continental land mass. Data for Timmins, a location at a similar latitude but away from the effects of the lake, are given for comparison. The temperature data show the major impact of the lake on the climate of Caribou Island with a cooling effect in the summer (July) and a warming in winter (January). However, the net effect is to considerably lower the annual number of "growing degree days" on the island—1750 on Caribou, 2100 at Timmins and 2500 at Sault Ste. Marie (Table 2).

Mean annual precipitation in the Lake Superior basin (Table 2) varies with location from about 711 mm (28″) to 965 mm (38″), with Caribou Island probably receiving about 812 mm (32″), over a quarter of it (ca. 212 mm) falling as snow. Rainfall during the growing season is, on average, evenly distributed without periods of drought (Table 2). Again the effect of the lake in ameliorating climatic extremes is apparent. Timmins, away from the effects of the lake, experiences much greater monthly variation in precipitation.

VEGETATION

Most of Caribou Island is made up of sand dunes, which provide a very limited range of habitats, all of which are acidic. The accumulation of peat has impeded drainage over much of the interior of the island and resulted in the development of bogs, acid lakes, and a few fens. Behind the mobile dunes, which surround most of the island, a boreal type of forest occupies the better-drained sites where peat has not accumulated. On the west side of the island fragments of the original glacial moraine from which the island was formed are exposed in the form of a cobble shore and, at the north end, boulder clay with a high content of gravel. The erosion of this moraine has produced the gravel which now forms the northern spit of the island and the lighthouse island at the south end. It is also the source of much of the rich, golden sand which is such a characteristic feature of Caribou Island.

The principal plant communities are: sand dunes, forest, bogs, acid lakes, fens, marshy woodland, and gravel shores.

TABLE 2 The climate of Caribou Island compared with that at stations on the shores of Lake Superior and at Timmins—a station at a similar latitude to Caribou Island but away from the effects of Lake Superior.

Mean daily temperature (°C)

	Caribou Is.	Wawa	Sault Ste. Marie	Grand Marais	Timmins
Jan.	–6.6	–13.3	–10.4	–6.9	–17.2
April	1.7	1.1	3.3	2.8	1.2
July	11.5	16.6	17.8	17.2	17.3
Oct.	6.8	5.5	7.4	8.1	4.5

Mean daily maximum (°C)

	Caribou Is.	Wawa	Sault Ste. Marie	Grand Marais	Timmins
Jan.	–3.3	–8.3	–5.5	–3.3	–10.9
April	4.4	5.5	8.5	7.2	7.5
July	14.6	21.1	24.3	23.3	24.3
Oct.	8.7	9.4	11.8	12.8	9.3

Mean daily minimum (°C)

	Caribou Is.	Wawa	Sault Ste. Marie	Grand Marais	Timmins
Jan.	–10.0	–16.7	–15.4	–11.1	–23.7
April	–1.1	–3.3	–2.0	–1.7	–5.2
July	8.4	11.1	11.2	11.1	10.3
Oct.	4.7	1.7	2.9	3.3	–0.3

Mean annual growing degree days above 5.6°C (42°F)

	Caribou Is.	Wawa	Sault Ste. Marie	Grand Marais	Timmins
	1750	2000	2500	2400	2100

Precipitation in mm

	Caribou Is.	Wawa	Sault Ste. Marie	Grand Marais	Timmins
January	(76.2)	71.1	74.4	55.9	54.6
February	—	66.0	50.7	43.2	44.5
March	—	58.4	60.4	43.2	62.4
April	(50.8)	66.0	65.2	50.8	50.1
May	64.7	81.3	70.8	68.6	69.6
June	68.7	81.3	83.1	83.8	94.7
July	66.6	68.6	65.6	68.6	100.1
August	78.3	99.1	85.3	66.0	90.3
September	75.3	109.2	95.2	83.8	91.8
October	68.7	88.9	83.2	58.4	74.4
November	65.8	83.8	90.3	76.2	76.3
December	—	68.6	81.9	55.9	64.6
Annual	(812.8)	939.8	905.9	762.0	873.4

Figures in parentheses are estimates based on rainfall maps for the region (Phillips & McCulloch 1972). Absence of a figure indicates that no data are available for that month.

Sand dunes

Most of the dunes around Caribou Island are steep, narrow and mobile, the shores being constantly pounded by waves and swept by the strong currents of Lake Superior. The main dune-stabilizing grass on the foredune is *Ammophila breviligulata*. On the shore the absence of annual species such as *Cakile edentula* and *Corispermum hyssopifolium* was noticeable, and may be due to the constant wash of waves and currents on the narrow, steep shore. Behind the foredune an area of stabilization is created by extensive mats of *Arctostaphylos uva-ursi, Empetrum nigrum, Hudsonia tomentosa, Potentilla tridentata,* and *Vaccinium angustifolium.* These are interspersed with *Ammophila breviligulata, Deschampsia flexuosa, Leymus mollis,* and *Prunus pumila.* The backs of the dunes are consolidated and stable, carpeted by patches of creeping species from the forest floor—*Cornus canadensis, Linnaea borealis, Lycopodium clavatum, Moneses uniflora,* and *Polygala paucifolia,* with an abundant growth of reindeer lichens (*Cladina* spp.). In this stabilized zone, and at the edge of the forest, clumps of shrubs occur. These include *Juniperus communis, Physocarpus opulifolius,* and *Rubus idaeus*. This narrow stabilized zone at the back of the dunes is a major area of accretion where most of the sand, blown in by the strong winds, is deposited as the air eddies and rises over the forest. The low forest perennials and shrubs which dominate this zone are able to grow through the sand as it is deposited. Thus they play a major role in dune building and stabilization. Many other perennial herbs grow on the dunes. They include *Anaphalis margaritacea, Chimaphila umbellata, Clintonia borealis, Cypripedium acaule, Danthonia spicata, Festuca saximontana, Geocaulon lividum, Lathyrus japonicus, Maianthemum canadense,* and *Melampyrum lineare*.

The edge of the forest behind the dunes is composed of *Abies balsamea, Betula papyrifera,* and *Picea glauca,* with scattered, often stunted trees of *Acer rubrum, Pinus strobus, Prunus pensylvanica,* and *Sorbus decora*. All are festooned with a luxuriant growth of lichens. *Taxus canadensis* often forms an impenetrable understory in the forest edge.

Frequent "blow-outs" occur in the dunes, where strong winds break through the mat of roots and blow away the sand. These areas are soon recolonized by *Ammophila breviligulata, Arctostaphylos uva-ursi, Hudsonia tomentosa, Leymus mollis,* and *Prunus pumila*.

The dunes on the west side of the island are not as steep or well developed as those on the east, but they have a similar flora with the addition of *Ledum groenlandicum,* a conspicuous feature at the back of the dunes and in the forest edge. The dunes in South Bay are more sheltered and much broader with a wide, stabilized grassy area at the back dominated by *Deschampsia flexuosa*. This area has scattered clumps of *Alnus viridis* and *Amelanchier bartramiana,* and several additional herbs: *Aralia nudicaulis, Artemisia campestris, Epilobium angustifolium, Equisetum arvense, Gnaphalium viscosum, Oenothera biennis, Phleum pratense,* and *Rumex acetosella*.

The dunes of Caribou Island are an excellent example of this type of community in the Upper Great Lakes region. They are poor in species compared with the dunes in other parts of the Great Lakes region, but are remarkable for the

extensive growth of *Hudsonia* and *Empetrum*, which act as stabilizing agents on the top of the dunes. Also of interest is the role of low mat-forming forest perennials in stabilizing the back of the dunes. The dominance of *Hudsonia* and *Empetrum* is probably related to the severity of the climate on Caribou Island and to the dunes being more acid than those in other regions of the Great Lakes where the bedrock is frequently of limestone. pH on the dunes ranges from 6 to 7, with the groundwater being 6.5 and the nearby waters of Lake Superior 6.8.

Forest

A boreal type of forest covers much of the island, apart from the coastal dunes and the low-lying areas of the interior where bogs and acid lakes prevent the growth of forest. Floristically this forest is very simple, the tree species being *Abies balsamea, Betula papyrifera,* and *Picea glauca,* with, on the better drained areas, scattered trees of *Sorbus decora.* Low-lying areas are dominated by *Betula papyrifera* and *Picea mariana.* Most of the forest is dense. Little light penetrates except where windfalls provide temporary openings in the canopy. Because of the low light intensity the understory is very open. The ground flora consists of typical boreal forest species, including *Clintonia borealis, Cornus canadensis, Dryopteris expansa, D. intermedia, Galium triflorum, Goodyera tesselata, Linnaea borealis, Lycopodium annotinum, L. lucidulum, Maianthemum canadense, Monotropa uniflora, Polygala paucifolia,* and *Trientalis borealis. Vaccinium membranaceum* forms a low thicket in areas where some light penetrates. Moist humus-rich hollows have a shrub layer of *Nemopanthus mucronatus* and *Vaccinium ovalifolium,* with *Coptis trifolia* and *Oxalis acetosella* on the ground. Swampy water-logged hollows are frequent in the old dune system on which the forest is growing. These hollows tend to be occupied by *Carex canescens, C. trisperma, C. vesicaria, Gaultheria hispida, Iris versicolor, Lysimachia terrestris, Potentilla palustris,* and *Viola macloskeyi.* In a few dry sandy areas where the forest is more open, *Pteridium aquilinum* occurs.

Bogs, acid lakes, and fens

Extensive bogs, peaty lakes, and small areas of fen occupy the low-lying interior of the island. The bogs developed when lakes impounded between the dunes became increasingly acid as they filled with humus and peat. Beavers have further impeded drainage and keep much of the area in a seral condition, preventing the transition from bog to forest.

Open water. Lakes and ponds are peaty, with a pH of 5.3–5.7—similar to that of the surrounding bogs. Most of the lake bottoms consist of a soft peaty ooze. The flora of the open water is limited to floating and a few submerged aquatics: *Brasenia schreberi, Nuphar ×rubridiscus, Potamogeton* spp., and *Utricularia* spp. Most of the ponds and lakes are shallow, and in the less acid ones *Eriocaulon* grows. In a few places, where the bottom is firmer and made up of sand and peat, it is carpeted with *Isoëtes.* Floating mats of bog vegetation encroach on the open water of the lakes. They are composed of *Sphagnum* moss interlaced with the stems and rhizomes of *Carex limosa, Eriophorum* spp.,

Menyanthes trifoliata, Potentilla palustris, Rhynchospora alba, and *Vaccinium oxycoccos.*

The bogs consist of a mat of sedges and *Sphagnum* spp. with scattered clumps of shrubs and occasional stunted trees of *Larix laricina* and *Picea mariana.* In a large bog behind South Bay there are scattered but moribund *Thuja occidentalis* trees. Common sedges include *Carex canescens, C. echinata, C. exilis, C. limosa, C. magellanica, C. michauxiana, C. oligosperma, C. rostrata, C. utriculata, Eriophorum vaginatum, E. virginicum, E. viridi-carinatum, Rhynchospora alba,* and *Scirpus cespitosus.* Shrubs consist of *Andromeda polifolia, Aronia melanocarpa, Chamaedaphne calyculata, Kalmia polifolia, Ledum groenlandicum,* and *Myrica gale.* There is a well-developed herbaceous flora, including *Aster nemoralis, Drosera anglica, D. intermedia, D. rotundifolia, Juncus pelocarpus, Lycopodium inundatum, Menyanthes trifoliata, Potentilla palustris, Sarracenia purpurea, Scheuchzeria palustris, Smilacina trifolia, Solidago uliginosa, Utricularia cornuta,* and *Xyris montana.*

Fens. Small areas of fen have developed around several of the lakes where the substrate is sandy and better aerated. Characteristic plants include *Aster nemoralis, Calamagrostis canadensis, Carex aquatilis, C. rostrata, Chamaedaphne calyculata, Eriophorum virginicum, E. viridi-carinatum, Euthamia graminifolia, Juncus alpino-articulatus, Ledum groenlandicum, Lycopus uniflorus, Myrica gale, Spiraea alba* var. *latifolia,* and *Triadenum fraseri.* A more extensive fen has formed behind South Bay Headland, probably on cobble and gravel deposits which provide better drainage. The area consists of sedge meadow and an extensive *Chamaedaphne* meadow. The sedge meadow is growing on relatively dry fibrous peat and is dominated by *Carex aquatilis, C. canescens, C. michauxiana, C. oligosperma, C. vesicaria,* and *Cladium mariscoides,* and *Calamagrostis canadensis.* Flowering herbs are plentiful and include *Cicuta bulbifera, Iris versicolor, Lysimachia terrestris, Menyanthes trifoliata, Platanthera hyperborea, Potentilla palustris,* and *Scutellaria galericulata.* The *Chamaedaphne* meadow is dominated by a dense low scrub of *Chamaedaphne calyculata* along with *Andromeda polifolia, Kalmia polifolia,* and *Ledum groenlandicum,* interlaced with *Vaccinium oxycoccos.* The peat is not very wet, though *Sphagnum* spp. grow under the scrub. Herbs include *Carex aquatilis, C. brunnescens, C. oligosperma, C. trisperma, Eriophorum vaginatum, Potentilla palustris,* and *Smilacina trifolia.*

Another different fen occurs at the south end of Long Slough and Deer Lake. Sand has been deposited behind the belt of forest at the back of the dunes. This peaty sandy area slopes gently into the lake and ranges from dry through marshy to inundated. It has one of the richest floras on the island. Species include *Carex brunnescens, C. rostrata, C. utriculata, Dulichium arundinaceum, Eleocharis tenuis, Eriocaulon aquaticum* (the terrestrial form), *Euthamia graminifolia, Hypericum majus, H. mutilum* ssp. *boreale, Iris versicolor, Juncus alpino-articulatus, J. brevicaudatus, J. filiformis, J. pelocarpus, Lysimachia terrestris, Panicum acuminatum* (in drier area), *Rhynchospora fusca, Vaccinium oxycoccos,* and *Viola lanceolata.* Habitats of this type appear to depend on the continued deposition of sand to maintain them in an open state. Also the well-aerated, less-acid conditions are more favourable to plant growth.

Marshy woodland and shores

Two areas of marshy woodland occur on exposed cobbles, gravel and boulder clay around the shores of Caribou Island. At the north end of Caribou Island, on Gull Island, open woodland and grassland give way to a well developed marsh. The woodland is composed of small trees of *Acer rubrum, Populus balsamifera,* and *Prunus pensylvanica* interspersed with scattered shrubs of *Diervilla lonicera, Physocarpus opulifolius, Ribes glandulosa, Rubus idaeus* and *Sambucus racemosa.* At the edge of the marsh these are replaced by *Alnus viridis, Cornus stolonifera, Myrica gale, Salix bebbiana,* and *S. candida.* The marsh is dominated by *Calamagrostis canadensis* and *Phalaris arundinacea,* but has a relatively rich flora, including *Barbarea vulgaris, Carex aquatilis, Euthamia graminifolia, Iris versicolor, Lathyrus palustris, Lysimachia terrestris, Menyanthes trifoliata, Platanthera hyperborea, Polygonum lapathifolium, Potentilla norvegica,* and *Thalictrum revolutum.* The drier grassy area is composed of *Elymus repens, Hierochloe odorata, Phleum pratense,* and *Poa compressa* with several herbs, including *Anemone canadensis, Cirsium arvense, Equisetum arvense, Potentilla anserina, Ranunculus acris, Rumex crispus, Taraxacum officinale,* and *Trifolium repens.* In the shade of the trees there are clumps of *Heracleum lanatum.*

A second area of marshy woodland consisting of tall *Sorbus decora* trees and *Betula papyrifera* with a dense thicket of *Alnus viridis* occurs on South Bay Headland, which is composed of consolidated cobbles and gravel. There is a fairly rich marsh flora underneath the trees. The species are mostly the same as those at the north end of the island, though additions include *Actaea rubra, Cinna latifolia, Pyrola elliptica, Symplocarpus foetidus,* and *Streptopus amplexifolius.*

Gravel Shores

The lighthouse is located on a gravel bank which forms a small island on a submerged reef about 1 km south of South Bay Headland. There are several mature *Sorbus decora* trees and clumps of shrubs, including *Cornus stolonifera, Diervilla lonicera, Physocarpus opulifolius, Ribes glandulosum, Rubus idaeus, R. parviflorus,* and *Sambucus racemosa.* The herbaceous flora is sparse and consists of alien weeds and shoreline adventives together with several forest species which grow under the scrub and trees. Aliens include *Capsella bursa-pastoris, Cerastium fontanum, Elymus repens, Erysimum cheiranthoides, Phleum pratense, Poa annua, Ranunculus acris, Rumex acetosella, R. crispus, Taraxacum officinale,* and *Trifolium repens.* Native species include *Achillea millefolium, Agrostis scabra, Calamagrostis canadensis, Carex aquatilis, Deschampsia flexuosa, Epilobium angustifolium, Equisetum arvense, Heracleum lanatum, Juncus dudleyi, Lathyrus japonicus, Lysimachia terrestris, Maianthemum canadense, Polygonum lapathifolium, Potentilla anserina, P. norvegica,* and *Streptopus amplexifolius,* together with *Poa compressa* and *P. pratensis* (which are probably of alien origin in this location).

The gravel spit at the north end of the island has a similarly sparse but even

poorer flora because the gravel is constantly being reworked by wave and ice action. Gravel shores occur in several of the bays on the west side of the island. They too have a similar flora but in addition have *Calamagrostis stricta* var. *inexpansa, Eleocharis smallii,* and *Equisetum variegatum.*

BIOGEOGRAPHY

Caribou Island does not have a very rich flora for an island with an area of 615 hectares. The present list contains 223 species, of which 16 are alien. By comparison, Barrier Island, an island of 39 ha in Georgian Bay, has 330 species; Mississagi Island, also 39 ha, in the North Channel of Lake Huron, has 242 species; Great Duck Island with 1482 ha in Lake Huron has 415 species, and Cove Island with 810 ha at the entrance to Georgian Bay has 375 species (Hogg, Morton & Venn 1989). The reason for the relatively small flora of Caribou Island is primarily its low diversity of habitats, all of which are to a greater or lesser extent acidic. The island consists of little more than sand dunes, low forest, and bog. Even the range of shoreline habitats is restricted to sand and small areas of gravel and cobbles. There are no rocky ledges or cliffs to provide a home for many of the rare plants found on the north shore of Lake Superior. Other factors contributing to low species diversity are cold winds and mist flowing off the icy waters of Lake Superior. These keep temperatures low throughout the growing season and greatly reduce the hours of sunshine. Their effects are apparent in the abundant growth of lichens which festoon the trees and carpet the bare sand at the back of the dunes. Distance from the mainland and from other islands is another factor and is no doubt the reason for the absence of reptiles and mammals other than beaver and bats. Lake Superior represents a greater barrier to animal dispersal than the distances involved suggest, owing to the very cold water of the lake. The near absence of mammals is reflected in the lack of bur-fruited plants. The flora is notable for the high proportion of species that are adapted to water dispersal. This is clearly demonstrated by a comparison of the species occurring on Caribou Island with those on Barrier Island (a small island in Georgian Bay, Lake Huron) which were studied for mode of dispersal (Morton & Hogg 1989). 82 of the species that occur on Caribou Island are amongst those tested in the above study and of these 65 (i.e., 80%) have adaptations for water dispersal. Bird dispersal is also important, with 35 of the species in the Caribou Island flora having succulent fruits. A few wind-dispersed species are also present; e.g., *Epilobium angustifolium.*

The flora of Caribou Island appears to be more closely related to that on the south side of Lake Superior rather than to the flora on the Canadian side of the lake. This is reflected in the presence of many species at, or very near, the northern limit of their distribution. Examples include *Aronia melanocarpa, Aster nemoralis, Cladium mariscoides, Hypericum mutilum, Nemopanthus mucronatus, Rubus canadensis, Symplocarpus foetidus, Thalictrum revolutum, Viola lanceolata,* and *Xyris montana.* Two factors have contributed to the

southerly affinity of the flora. Firstly, habitats on the north shore of Lake Superior are dominated by the outcropping rocks of the Precambrian Shield. As these rocky habitats are absent from Caribou Island, so are their characteristic plants. Secondly, water is the major mode of dispersal of plants to Caribou Island. The surface currents to which the island is exposed come from the south, flowing around Lake Superior in an anti-clockwise direction (see Fig. 1) and hence bringing propagules from the south shore of the lake.

Despite its southerly affinities, the flora of Caribou Island includes elements from other regions. *Potamogeton confervoides* is an eastern species reaching the western limits of its range on Caribou Island. Maritime species include *Ammophila breviligulata, Lathyrus japonicus,* and *Leymus mollis.* Species from western North America which have disjunct populations in the Great Lakes region and occur on Caribou Island include *Rubus parviflorus, Vaccinium membranaceum,* and *V. ovalifolium. Amelanchier alnifolia* is a prairie species which occurs in scattered localities around the north shore of Lake Superior and on Caribou Island. There are several characteristically northern species on the island which are at, or near, their southern limits. They include *Carex magellanica, Empetrum nigrum, Hudsonia tomentosa, Ribes glandulosum, R. oxyacanthoides,* and *Solidago uliginosa.*

CONSERVATION

Though the flora of Caribou Island is limited by the low diversity of habitats, its sand dunes, bogs, and forest are superb examples of these communities in the Upper Great Lakes region. The flora of the island contains several species which are sufficiently rare or restricted in their distribution to be worthy of note. They include:

Potamogeton confervoides. A plant of acid waters in northeastern America. Rare in Ontario and threatened in Michigan. (Hellquist & Pryer 1987 *in* Argus *et al.* 1982–87).

Vaccinium membranaceum and *V. ovalifolium.* Both are western species with disjunct populations in the Great Lakes region.

Thalictrum revolutum. This is a species of woodland in the east and southeast United States, rare in Canada and threatened in Michigan. (White & Dickson 1983 *in* Argus *et al.* 1982-87). On Caribou Island this species is at its northern limit.

Rubus parviflorus. This is another western species with disjunct populations in the Great Lakes region.

Of much greater significance, however, from a conservation perspective, is the remoteness of Caribou Island, which makes it of considerable biogeographic interest, particularly because the island is almost untouched by human activity. Several factors make Caribou Island a place of special significance: the rich flora on the extensive series of bogs in the interior of the island; the simple but

interesting forest flora in which *Vaccinium membranaceum* and *V. ovalifolium* are a prominent feature; and the superb dune system which is remarkable for the abundance of *Hudsonia tomentosa* and *Empetrum nigrum* as sand-binding species. Because of its scientific interest the island should be preserved in its present pristine condition. Its remoteness and relatively simple plant communities and flora make Caribou Island a superb outdoor laboratory for biogeographic and ecological studies.

HISTORY OF THE ISLAND

Caribou Island was known to the Ojibwa Indians of Lake Superior as the Island of the Yellow Sands. However, they shunned the island, believing it to be the home of evil spirits. The first reference to the island in European literature appears to be on an early Jesuit map of Lake Superior published in 1672 on which the island is accurately located but not named (Carter 1979). Whether the island was actually visited by the Jesuit priests, who were amongst the earliest Europeans to travel in the region, is not known. Subsequently the island appeared on maps under the name Isle Ste. Anne (Carter 1979). Alexander Henry appears to have been the first European to visit the island. Drawn by the possibility of finding gold, he landed there in 1771 and reported on the abundance of caribou, from which the island presumably gained its current name. The first lighthouse on the island was a wooden-framed structure erected in 1886 on the site of the present concrete lighthouse, which was built in 1911.

The caribou herd which inhabited the island at the time of Henry's visit subsequently died out; whether by disease or from hunting by the lighthouse keepers and others is not known. In 1903 ownership of most of the island passed from the Crown to a group of Americans who intended to restock it with caribou and use it as a hunting preserve. This was done with animals originating from Newfoundland. By 1912 the herd numbered about 50, but the numbers dwindled and the last animal was killed in 1950 (Carter 1979).

Apart from the lighthouse no permanent structures have been erected on the island, though temporary fishing camps have from time to time been set up in South Bay, and at the time of our visit a small wooden cabin had been constructed on stilts at the edge of the forest on the east side of the island. In 1946 the Canadian Government proposed to build an emergency air strip on the island to cater to the needs of the developing air transportation industry. Survey teams visited the island and carried out test drillings to determine the nature and depth of the surface deposits. Fortunately the plan was abandoned and the island has remained almost undisturbed.

BOTANISTS AND OTHER VISITORS TO THE ISLAND

Because of its remoteness Caribou Island has received few visitors. At the end of July 1931 Carl O. Grassl and Dr. Walter Koetz (a zoologist) visited the

island by sailboat. Though Grassl collected plants on this visit, no list of the collections has been published. The specimens were incorporated into the University of Michigan Herbarium at Ann Arbor, and a few duplicates exist in the herbarium of the National Museum of Canada in Ottawa. During our 1976 visit to the island, reported on here, we noted the occurrence of 223 species of vascular plants on the island and described the major plant associations. In July 1977 James L. Carter and his brother David visited the island and subsequently published a very readable account of the history of the island (Carter 1979). In 1979 and 1981 Alan Wormington, Robert Finlayson, and J. Robert Nisbet visited Caribou Island. (Wormington, Nisbet, & Finlayson 1986). Though their visits were primarily devoted to the study of birds, they produced an important plant record of Skunk Cabbage on the island (Wormington pers. comm.). Paul Martin Brown visited the island and in July of 1982 produced a list of 205 plants that he observed. As far as we have been able to ascertain this list has not been published and is not supported by voucher collections.

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THE FLORA

Arrangement of the species is in alphabetical order of and within families under Pteridophytes (ferns & fern-allies), Gymnosperms, and Angiosperms (flowering plants). Nomenclature follows Morton & Venn 1990.

* = indicates that the species is not native to the island

Voucher specimens of most of the species were collected. A complete set is based in herb. J.K. Morton with duplicates in WAT, CAN & MICH.

PTERIDOPHYTES

FERNS

OPHIOGLOSSACEAE

Botrychium multifidum (S.G. Gmelin) Ruprecht At the back of the dunes in South Bay.

B. virginianum (L.) Swartz Grassy area on Gull Is.

DRYOPTERIDACEAE

Dryopteris carthusiana (Villars) H.P. Fuchs Gull Is.

D. expansa (C. Presl) Fraser-Jenkins & Jermy Common in better drained places in the forest.

D. intermedia (Muhl. ex Willd.) A. Gray Common in the forest. What appears to be **D. ×triploidea* occurs with it at the north end of the island.

Gymnocarpium dryopteris (L.) Newman Amongst cobbles in open woods on South Bay Headland.

OSMUNDACEAE

Osmunda cinnamomea L. In fen at back of South Bay Headland.

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn In better drained situations.

FERN-ALLIES

EQUISETACEAE

Equisetum arvense L. Confined to situations with gravel or cobbles.

E. fluviatile L. In fen behind South Bay Headland.

E. ×mackaii (Newman) Brichan *(E. hyemale × E. variegatum)* On marshy shore at north end of the island.

E. variegatum Schleicher With the preceding hybrid.

ISOETACEAE

Isoëtes echinospora Durieu Abundant in the peaty bottom of Deer Lake.

LYCOPODIACEAE

Lycopodium annotinum L. Common on the forest floor.

L. clavatum L. Common at the back of the dunes and in the forest edge.
L. complanatum L. In the forest edge at the back of the dunes.
L. dendroideum Michaux In open forest at the south end of the Long Slough.
L. inundatum L. Creeping over wet peat in bogs and at the edge of lakes.
L. lagopus (Laest.) Zinserl ex Kuzen Growing with *L. clavatum* in many places. Treated as a variety of that species by most workers.
L. lucidulum Michaux Common on the forest floor.
L. obscurum L. In the forest edge at the north end of the island.
L. tristachyum Pursh On stabilized dunes in West Bay.

GYMNOSPERMS

CUPRESSACEAE
Juniperus communis L. Common at the back of the dunes.
Thuja occidentalis L. A few moribund trees on a bog in the interior of the island by the South Bay trail.

PINACEAE
Abies balsamea (L.) Miller Common in the forest.
Larix laricina (Duroi) K. Koch Common on bogs.
Picea glauca (Moench) Voss Common in the forest and at the back of the dunes.
P. mariana (Miller) Britton, Sterns & Pogg. Common on the bogs in the interior of the island.
Pinus strobus L. A few stunted trees on the dunes on the east side of the island.

TAXACEAE
Taxus canadensis Marsh. A common understory shrub. Also at the back of the dunes.

ANGIOSPERMS

ACERACEAE
Acer rubrum L. Scattered stunted trees at the back of the dunes in West Bay and in the forest edge at the north end of the island.

AQUIFOLIACEAE
Nemopanthus mucronatus (L.) Loes. Common around bogs, in swampy openings in the forest and in fens.

ARACEAE
Symplocarpus foetidus (L.) Salisb. ex Nutt. Reported by Mr. Alan Wormington in 1979 from the alder thicket on South Bay Headland.

ARALIACEAE
Aralia hispida Vent. Locally common at the back of the dunes and in sandy openings in the forest.
A. nudicaulis L. Abundant on the forest floor.

BALSAMINACEAE
Impatiens capensis Meerb. Swampy openings in the forest and marshy places.

BETULACEAE
Alnus viridis (Chaix) DC. subsp. *crispa* (Dryander ex Aiton) Turrill Marshy shores on stony ground. Forming a thicket on South Bay Headland.
Betula papyrifera Marshall An abundant tree over most of the island.

CABOMBACEAE
Brasenia schreberi J. Gmelin In the peaty waters of Deer Lake and the Long Slough.

CAPRIFOLIACEAE

Diervilla lonicera Miller var. *lonicera* Restricted to well drained gravel and cobbles at the north end of the island and beside the lighthouse.

Linnaea borealis L. Abundant on the forest floor and on stabilized dunes.

Sambucus racemosa L. subsp. *pubens* (Michaux) House Well drained and stony places at the north end of the island and around the lighthouse.

CARYOPHYLLACEAE

**Cerastium fontanum* Baumg. An alien weed around the lighthouse.

Stellaria borealis Bigelow subsp. *borealis* Marshy grassy places on Gull Is. and behind South Bay Headland.

CISTACEAE

Hudsonia tomentosa Nutt. Dominant on most of the dunes behind the fore-dune zone. Forming mats and low cushions.

COMPOSITAE

Achillea millefolium L. subsp. *lanulosa* (Nutt.) Piper Around the lighthouse.

Anaphalis margaritacea (L.) Benth. & Hook. f. Frequent at the back of the dunes.

Artemisia campestris L. subsp. *borealis* (Pallas) H.M. Hall & Clements On stabilized dunes on the south shores.

Aster lanceolatus Willd. subsp. *lanceolatus* Confined to marshy area on Gull Is.

A. nemoralis Aiton Common in bogs and around the peaty lakes in the interior of the island.

**Cirsium arvense* (L.) Scop. An alien weed on the marshy shore at the north end of the island.

Euthamia graminifolia (L.) Nutt. Frequent on marshy shores and in fen-like situations.

Gnaphalium viscosum Kunth On the dunes in South Bay.

Hieracium canadense Michaux South Bay, on cobble shores and the back of the dunes.

Solidago uliginosa Nutt. Uncommon but occurring in the bogs behind the west shore.

**Taraxacum officinale* G. Weber An alien weed around the lighthouse and on cobble shores at the north end of the island.

CORNACEAE

Cornus canadensis L. Abundant on the forest floor and on the stabilized dunes where it is often dominant.

C. stolonifera Michaux On marshy shores of gravel and cobbles.

CRUCIFERAE

**Barbarea vulgaris* R.Br. Noted only on the cobble shores of Gull Is.

**Capsella bursa-pastoris* (L.) Medikus An alien weed around the lighthouse.

Descurainia richardsonii (Sweet) O.E. Schulz On the gravel shore at the lighthouse.

**Erysimum cheiranthoides* L. An alien weed at the lighthouse.

CYPERACEAE

Carex aquatilis Wahlenb. Common in marshy places, fens, and the less acid bogs.

C. brunnescens (Pers.) Poiret In fens.

C. buxbaumii Wahlenb. In the marshy bay at Gull Is.

C. canescens L. Common in fens, bogs, and swampy openings in the forest.

C. echinata Murray A common tussock sedge of bogs. Also on gravelly shores on the west side of the island.

C. exilis Dewey Common in bogs.

C. lenticularis Michaux Noted only in a wet sandy depression at the south end of the Long Slough.

C. limosa L. Common in the wettest parts of bogs and in shallow peaty ponds.

C. magellanica Lam. subsp. *irrigua* (Wahlenb.) Hüt. (= *C. paupercula* Michaux) Common in very wet bogs and shallow peaty lakes and ponds.

C. michauxiana Boeckeler Common in bogs.

C. oligosperma Michaux Common in the less acid bogs and around inland lakes and ponds.

C. rostrata Stokes Common in wet places.
C. stricta Lam. Local on marshy shores and in fens.
C. trisperma Dewey Common in swampy areas in the forest and forest edge.
C. utriculata F. Boott. Common in the bogs.
C. vesicaria L. Common in wet places.
Cladium mariscoides (Muhlenb.) Torrey In the fen behind South Bay Headland.
Dulichium arundinaceum (L.) Britton In fen-like habitat by the Long Slough.
Eleocharis acicularis (L.) Roemer & Schultes Abundant on bare wet peat by Deer Lake.
E. smallii Britton On marshy shores at the north end of the island and around the Long Slough and Deer Lake.
E. tenuis (Willd.) Schultes On wet sand at south end of the Long Slough.
Eriophorum vaginatum L. subsp. *spissum* (Fern.) Hultén Forming tussocks in the bogs.
E. virginicum L. Common in bogs. Not tussock forming.
E. viridi-carinatum (Engelm.) Fern. Common in bogs and around the edge of the inland lakes.
Rhynchospora alba (L.) M. Vahl Common in very wet bare peat in bogs.
R. fusca (L.) Aiton f. Common in bogs.
Scirpus cespitosus L. Forming tussocks in bogs.
S. cyperinus (L.) Kunth In fens and swampy openings in the forest. Only the form with pedicellate spikelets was noted.

DROSERACEAE

Drosera anglica Hudson In bogs, but not common.
D. intermedia Hayne Fairly common in bogs.
D. rotundifolia L. Common in bogs.

EMPETRACEAE

Empetrum nigrum L. Common on the dunes, often forming extensive carpets.

ERICACEAE

Andromeda polifolia L. subsp. *glaucophylla* (Link) Hultén Common in bogs and fens.
Arctostaphylos uva-ursi (L.) Sprengel Abundant on the dunes and in the forest edge.
Chamaedaphne calyculata (L.) Moench Abundant and often dominant in fens and in the less acid bogs.
Gaultheria hispidula (L.) Muhlenb. Common in the forest and forest edge.
Kalmia polifolia Wangenh. Common in bogs.
Ledum groenlandicum Oeder Common in bogs, around the inland lakes, and in swampy openings in the forest.
Vaccinium angustifolium Aiton Abundant on the dunes.
V. membranaceum Douglas Common on the forest floor.
V. ovalifolium Smith Common on the forest floor.
V. oxycoccos L. Abundant in the bogs.

ERIOCAULACEAE

Eriocaulon aquaticum (Hill) Druce Abundant on wet sandy peat at the edge of Deer Lake and the Long Slough.

GRAMINEAE

Agrostis perennans (Walter) Tuckerman In forest edge on west side of the island.
A. scabra Willd. Common in marshy ground.
Ammophila breviligulata Fern. The dominant grass on the dunes.
Calamagrostis canadensis (Michaux) P. Beauv. Abundant in wet places.
C. stricta (Timm) Koeler subsp. *inexpansa* (A. Gray) C.W. Greene Marshy shores at north end of the island.
Cinna latifolia (Trevir.) Griseb. In damp woods behind South Bay Headland.
Danthonia spicata (L.) P. Beauv. Common on the back of dunes and around the lighthouse.
Deschampsia flexuosa (L.) Beauv. Abundant on the dunes, in dry openings in the forest and on shores.

Elymus repens (L.) Gould An alien grass which was noted around the lighthouse and at the north end of the island.
Festuca saximontana Rydb. On the dunes.
Glyceria canadensis (Michaux) Trin. In wet sandy peat around Deer Lake and the Long Slough.
Hierochloe odorata (L.) P. Beauv. At the back of the dunes on the west side of the island and in grassy area at the north end.
Leymus mollis (Trin.) Pilger Common on the dunes.
Panicum acuminatum Sw. On a sandy area at the south end of the Long Slough.
Phalaris arundinacea L. On marshy shore at the north end of the island.
**Phleum pratense* L. An alien weed around the lighthouse, on the shore at the north end, and on the dunes in South Bay.
**Poa annua* L. An alien weed around the lighthouse.
P. compressa L. On gravel at the lighthouse and at the north end.
P. palustris L. On gravelly shores at the lighthouse, on South Bay Headland, and on the back of the dunes in South Bay.
**P. pratensis* L. subsp. *pratensis* Around the lighthouse. Probably introduced.

GROSSULARIACEAE
Ribes glandulosum Grauer On gravel and cobbles—at the lighthouse, the northern tip of the island and South Bay Headland.
R. oxyacanthoides L. On the gravel at the lighthouse.

GUTTIFERAE
Hypericum majus (A. Gray) Britton On wet sandy area at south end of the Long Slough.
H. mutilum L. subsp. *boreale* (Britton) J.M. Gillett With the preceding species.
Triadenum fraseri (Spach) Gleason In fen by Deer Lake.

IRIDACEAE
Iris versicolor L. Common on fens, marshes and shores.
Sisyrinchium montanum E. Greene In the marshy area at the northern tip of the island.

JUNCACEAE
Juncus alpino-articulatus Chaix On wet sandy area at the south end of Deer Lake.
J. brevicaudatus (Engelm.) Fern. Fen-like situations by Deer Lake and the Long Slough.
J. dudleyi Wieg. On the shore at the lighthouse.
J. filiformis L. Fen-like situations by Deer Lake and the Long Slough.
J. pelocarpus E. Meyer On bare wet peat and sand by Deer Lake and the Long Slough.

LABIATAE
Lycopus uniflorus Michaux Around the edge of Deer Lake.
Scutellaria galericulata L. In fen behind South Bay Headland.

LEGUMINOSAE
Lathyrus japonicus Willd. Common on the dunes and also around the lighthouse.
L. palustris L. Marshy grassland on Gull Is.
**Trifolium repens* L. An alien weed around the lighthouse and in grassy area at the north end of the island.

LENTIBULARIACEAE
Utricularia cornuta Michaux Wet peat by Deer Lake and in the bog behind West Bay.
U. intermedia Hayne Common in pools in the bogs.
U. vulgaris L. In Deer Lake.

LILIACEAE
Clintonia borealis (Aiton) Raf. Common on the forest floor. Also at the back of the dunes.
Maianthemum canadense Desf. Common on the forest floor.
Smilacina trifolia (L.) Desf. Common in bogs.
Streptopus amplexifolius (L.) DC. In woodland behind South Bay Headland and on Gull Is. Also by the lighthouse.

MENYANTHACEAE

Menyanthes trifoliata L. Common in pools and in bogs.

MONOTROPACEAE

Monotropa uniflora L. Occasional on the forest floor.

MYRICACEAE

Myrica gale L. In fens and the less acid bogs. Also in marshy area at north end.

NYMPHAEACEAE

Nuphar ×rubrodiscum (Morong) Fern. In Deer Lake.

ONAGRACEAE

Epilobium angustifolium L. Common in open, well-drained places—back of dunes, gravelly places, cobble shores, forest edge.

E. ciliatum Raf. Marshy shore at the north end of the island.

E. leptophyllum Raf. Marshy woodland on South Bay Headland.

Oenothera biennis L. On the dunes in South Bay.

ORCHIDACEAE

Cypripedium acaule Aiton Occasionally in the forest. Also at the back of the dunes.

Goodyera tesselata Lodd. In the open forest and at the back of the dunes on the east side of the island.

Platanthera clavellata (Michaux) Luer In the fen behind South Bay Headland and in a bog on the west side of the island.

P. hyperborea (L.) Lindley In marshy grassland at the north end of the island and in the fen behind South Bay Headland.

OXALIDACEAE

Oxalis acetosella L. Occasional on the forest floor.

POLYGALACEAE

Polygala paucifolia Willd. Common on the forest floor and at the back of the dunes.

POLYGONACEAE

Polygonum amphibium L. In marshy ground at the north end of the island.

P. cilinode Michaux In scrub at the north end of the island.

P. lapathifolium L. Weedy at the lighthouse and on Gull Is.

**Rumex acetosella* L. Scattered on the dunes and also at the lighthouse. An alien weed.

**R. crispus* L. An alien weed at the lighthouse and on the shore at the north end of the island.

POTAMOGETONACEAE

Potamogeton alpinus Balbis In the bay between Gull Is. and the north point.

P. confervoides Reichb. In peaty edge of Deer Lake.

P. epihydrus Raf. Deer Lake.

P. gramineus L. In the sheltered water between Gull Is. and the north point.

P. natans L. Stunted plants in the peaty water at the south end of Deer Lake.

P. richardsonii (A. Bennett) Rydb. In sheltered water at the north end of the island.

PRIMULACEAE

Lysimachia terrestris (L.) Britton, Sterns & Pogg. Common in fens and marshes.

Primula mistassinica Michaux On gravelly shore at north end of the island.

Trientalis borealis Raf. Common on forest floor and at the back of the dunes.

PYROLACEAE

Chimaphila umbellata (L.) Barton At the back of the dunes on the east side of the island.

Moneses uniflora (L.) A. Gray Occasional on the forest floor. More frequent at the back of the dunes.

Pyrola elliptica Nutt. Occasional in the forest edge.

RANUNCULACEAE

Actaea rubra (Aiton) Willd. Amongst cobbles in woodland on South Bay Headland.

Anemone canadensis L. In marshy grassland at the north end of the island.

Coptis trifolia (L.) Salisb. subsp. *groenlandica* (Oeder) Hultén Frequent on the forest floor.

**Ranunculus acris* L. An alien weed around the lighthouse and on the gravelly shore at the north end.

R. reptans L. On wet sandy shore at the south end of the Long Slough.

Thalictrum revolutum DC. On marshy shore at north end of the island.

ROSACEAE

Amelanchier alnifolia Nutt. On shore at north end and at the back of the dunes in West Bay.

A. bartramiana (Tausch) Roemer On gravel and cobbles at South Bay Headland and at the north end. Also on dunes in South Bay.

Aronia melanocarpa (Michaux) Elliott Frequent in bogs.

**Malus pumila* Miller A single small tree on the dunes in South Bay.

Physocarpus opulifolius (L.) Maxim. Frequent on the gravel and cobble shores. Occasional in the forest edge at the back of the dunes.

Potentilla anserina L. Confined to gravel and cobble shores.

P. norvegica L. Weedy around the lighthouse and on the shore at the north end.

P. palustris (L.) Scop. Common in bogs and fens.

P. tridentata Sol. ex Aiton Abundant on the dunes.

Prunus pensylvanica L.f. Scattered, usually stunted trees around the shores of the island.

P. pumila L. On the dunes.

Rosa acicularis Lindley Near the shore at the north end of the island. Variable with some plants tending to be intermediate between this species and *R. blanda*.

Rubus canadensis L. On the back of the dunes in West Bay.

R. idaeus L. subsp. *melanolasius* (Dieck) Focke Common in the forest edge around the shoreline.

R. parviflorus Nutt. A clump on the gravel of the lighthouse island.

R. pubescens Raf. In several places in woodland and the forest edge.

Sorbus decora (Sarg.) C. Schneider Common. Usually in the forest edge but the dominant tree in the woodland on South Bay Headland.

Spiraea alba Duroi var. *latifolia* (Aiton) Dippel In fen-like situations by Deer Lake and the Long Slough.

RUBIACEAE

G. asprellum Michaux In fen behind South Bay Headland.

Galium tinctorium L. In fen by Deer Lake and the Long Slough and the marsh at the north end of the island.

G. triflorum Michaux Common on the forest floor.

SALICACEAE

Populus balsamifera L. A few stunted trees at the north end of the island.

Salix bebbiana Sarg. On gravel at the north end of the island.

S. candida Flügge In marshy ground at the north end of the island.

S. lucida Muhlenb. In thicket and woodland on cobbles at South Bay Headland.

**S.* ×*rubens* Schrank Several large shrubs at the north tip of the island. An introduced willow which is commonly planted. On Caribou Is. branches probably washed ashore and rooted in the gravel.

SANTALACEAE

Geocaulon lividum (Richardson) Fern. Frequent at the back of the dunes in the forest edge.

SARRACENIACEAE

Sarracenia purpurea L. Common in the bogs.

SCHEUCHZERIACEAE

Scheuchzeria palustris L. In several of the bogs.

SCROPHULARIACEAE

Melampyrum lineare Desr. At the back of the dunes on the east side of the island.

SPARGANIACEAE

Sparganium emersum Rehmann subsp. *acaule* (Beeby) C. Cook & M.S. Nicholls In Deer Lake.

UMBELLIFERAE

Cicuta bulbifera L. In fen behind South Bay Headland.

Heracleum lanatum Michaux On gravel and cobbles under trees—the lighthouse, the northern tip of the island and South Bay Headland.

VIOLACEAE

Viola blanda Willd. In fen behind South Bay Headland.

V. lanceolata L. In sandy slack at south end of the Long Slough.

V. macloskeyi F. Lloyd In marshes and fens, common.

XYRIDACEAE

Xyris montana Ries Common on wet peat in the bogs and around the inland lakes.

SPECIAL ANNOUNCEMENT

Michigan Flora, Volume III, by Edward G. Voss, is now available! It can be ordered for $15.00 + shipping and handling from Cranbrook Institute of Science, 1221 North Woodward Avenue, P.O. Box 801, Bloomfield Hills, MI 48303 (810-645-3239 or 810-645-3203 for credit card orders). A review of this long-awaited work will appear in the next issue of the *Botanist*.

The RED CEDAR CHAPTER announces the establishment of the: ISOBEL DICKINSON MEMORIAL AWARD

Once adequately funded, this annual award will be presented to the best nominated student authored paper published during a given year (volume) in *The Michigan Botanist*. Funding for this award will come from annual dividends generated by the Dickinson "Trust" Fund. It is estimated that (depending on interest rates), we need to raise about $3500 to award $100.00 annually. Eventually we would like to increase the dollar amount of the award and/or be able to offer multiple awards. Thus, ***donations are always welcome.***

TAX DEDUCTIBLE DONATIONS to the fund can be made by sending checks to "The Michigan Botanical Foundation" c/o Dr. Elwood B. Ehrle, Department of Biological Sciences, Western Michigan University, Kalamazoo, 49008. ***To assure proper credit to the award, please be sure to indicate on your check that the donation is to go to the "DICKINSON MEMORIAL AWARD".***

Any questions? Please feel free to contact: Dr. Patrick F. Fields—chmn., Dickinson Award Committee, Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824-1312 or phone: (517) 355-4692, or E-Mail: fieldspa@pilot.msu.edu; or Dr. Ehrle (listed above).

THE BIG TREES OF MICHIGAN
13. Quercus macrocarpa L.

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Michigan's largest known Bur Oak is located in Niles, Michigan, in Berrien County, the southwestern-most county of lower Michigan.

Description of the Species: Oaks are members of the Fagaceae (Beech Family). There are three genera in Michigan: *Fagus* (Beech), *Castanea* (Chestnut), and *Quercus* (Oak). Although all genera have alternate and simple leaves, a number of characteristics differentiate the oaks from other members of the family. Oaks have variously lobed and cut leaves [with the exceptions of *Q. muehlenbergii* Engelm. (Chinquapin Oak) and *Q. imbricaria* Michx. (Shingle Oak)], pubescence in the axils of the major veins, winter buds clustered at the end of the shoot tip, and fruit encased in a cup of overlapping scales (Gleason & Cronquist 1991). The fruit (acorn) is so distinctive that it can reliably be used to identify the genus *Quercus*.

Because the leaves do not have sharply pointed or bristled tips but instead have smooth, rounded lobes, *Q. macrocarpa* Michx. (Bur Oak) may be classed within a group of oaks called white oaks, which includes *Q. bicolor* Willd. (Swamp White Oak) and *Q. alba* L. (White Oak) among Michigan members of the genus *Quercus*. The leaves of the Bur Oak are oblong to oblong-obovate and are widest above the middle (See Fig. 1). The sinuses of the middle portion of the lobed leaf extend almost to the midrib (Barnes & Wagner 1991). The undersides of the leaves are often covered with fine, white, star-shaped hairs. Voss (1985) also indicates that the branches, when young, are densely pubescent, becoming corky and winged with age. The acorn is 1/3 or more encased within a pubescent-lined cup that exhibits a wide, fleshy-fringed margin.

Location of Michigan's Big Tree: Niles is located on the banks of the St. Joseph River in southwest lower Michigan. Significant highways that converge in Niles are the business loop of U.S. route 31 as well as M-51 and the business loop of U.S. route 12. The Bur Oak is located in the back yard of a home at 702 Chippewa Trail, a residential street that intersects with Chicago Road (the name

[1]Deceased 20 September 1994.

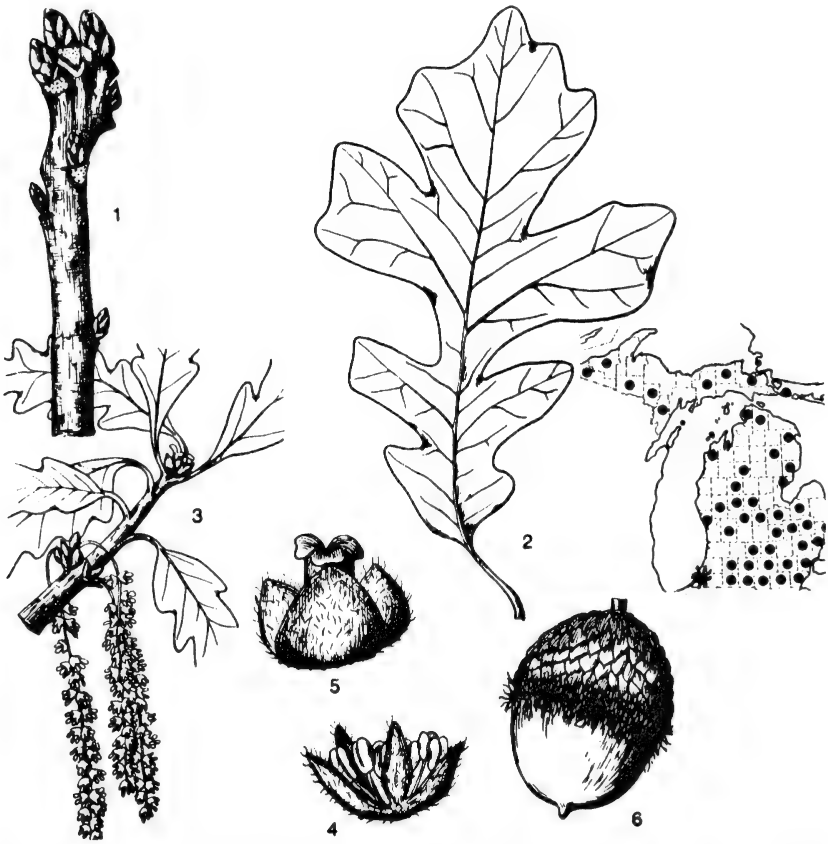

FIGURE 1. Documented distribution in Michigan and characteristics of the Bur Oak. Map is from Voss (1985). The star indicates the location of Michigan's Big Tree. Illustrations are from Barnes & Wagner (1991). 1. Winter twig, x2; 2. Leaf, x1/3; 3. Flowering shoot, x1/2; 4. Male flower, enlarged; 5. Female flower, enlarged; 6. Fruit, acorn, x1.

of U.S. route 12 at this intersection). Chicago Road and Chippewa Trail intersect 1.6 miles southwest of the U.S. route 12 bridge over the St. Joseph River.

Description of Michigan's Big Tree: This truly magnificent Bur Oak is highly branched and symmetrical. It dominates the neighborhood with its branches overspreading the house, the entire back yard, half the side yard, and much of the neighbor's yard. Perhaps because its branches and trunk have received skillful professional attention (a major split down the center of the tree has been laced with steel rods and a crack on the NE side of the tree has been patched with masonry), the tree is still growing and appears very healthy. When last measured in 1985, the trunk had a girth of 286″ (Thompson 1986). It now measures 288″ (732 cm). The crown spread averages 106′ (32 m) in diameter (radius at 4 cardinal points: N 47′, S 51′, E 62′, W 53′) and currently tops out at 92′ (28 m) above the ground level. Height to the first branch is about 12′ (3.7 m).

It appears that this Michigan tree may have been taller because some of the uppermost branches were apparently taken off. Honey bees are living in the tree and have an entrance hole at the top of the masonry patch. There is a slight scar on the east side of the trunk. Even with these signs of age, this tree is picture perfect at any angle. Voucher specimens of this tree are being prepared for filing in the Hanes Herbarium (WMU) and the Herbaria at Michigan State University (MSC) and the University of Michigan (MICH).

On the west side of the house there is another Bur Oak that is an impressive tree. Were it not for the Michigan Big Tree a mere stone's throw away, this smaller tree could easily be the pride of the neighborhood. With a girth of 194″ it may just be a matter of time before it takes over as a champion.

INVITATION TO PARTICIPATE

If you would like to join us in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B. Ehrle for help with locations, specifications for taking measurements and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property.

LITERATURE CITED

Barnes, B. V., & W. H. Wagner, Jr. 1991. *Michigan Trees.* A Guide to the Trees of Michigan and The Great Lakes Region. Univ. of Michigan Press, Ann Arbor. viii + 383 pp.

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ANNOUNCEMENT
FIRST ANNUAL DICKINSON AWARD

Isobel Adkins Dickinson (1921–1993) was a founding member of the Red Cedar Chapter of the Michigan Botanical Club. Further, she served as its Treasurer (1973–1993), Secretary (1989–1993), and Representative of the Chapter on the State Board of the Club (1980–1993). She is fondly remembered by all, and the loss of her battle with cancer (on September 26, 2993), is deeply felt to this day.

In addition to her great love of plants, Isobel had a great love of young people and strongly encouraged student participation in Michigan Botanical Club activities. Thus, our chapter has established this award in her honor.

The Red Cedar Chapter of the Michigan Botanical Club is pleased to announce that the **Isobel Dickinson Memorial Award** Fund has reached sufficient levels to be able to make its first annual award (anticipated to be $100.00). This award is for the best student authored paper published in a given volume of *The Michigan Botanist.* The first award will be for papers published in volume 35 (for the year 1996).

Once all four numbers of a given year's volume are published, nominations will be accepted. Look for more complete details (award criteria, mechanics of application, etc.) in volume 35 number 4. In the meanwhile, direct questions to: Dr. Patrick F. Fields—chmn., Dickinson Award Committee, Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824-1312 or phone: (517) 355-4692, or E-mail: fieldspa@pilot.msu.edu.

PRESETTLEMENT VEGETATION OF THE LOWER CHIPPEWA RIVER VALLEY

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INTRODUCTION

The lower Chippewa River of west-central Wisconsin is the portion that flows southwest from the city of Eau Claire to the Mississippi River at Nelson. The river has a gentle gradient of about 0.8 m/km and highly erodible banks of sand and gravel. The river valley occurs between 35 m to 70 m below the surrounding upland, is between 1 and 5 km wide, and was formed primarily by glacial meltwaters. The floodplain is defined by annual high water levels and is generally below the 25 year flood recurrence interval, which on this part of the Chippewa River is >5m (Peterson & Gamble 1968). No dams have been constructed along this stretch, although some dredging and bank stabilization projects were conducted early in this century to keep the river navigable for steamboats.

Cultivation, grazing, logging, and the cessation of fire which accompanied European settlement greatly affected upland vegetation. Little settlement occurred in the flood-prone areas owing to steep banks and frequent flooding, resulting in a lesser impact on lowland vegetation. Although no dams occur on the Chippewa River below Eau Claire, many were built on the upstream stretches, and they alter the natural flow regime of the river by reducing peak flows during floods.

This is a study of the presettlement vegetation of a river valley. Earlier studies of the original vegetation of Wisconsin dealt with upland vegetation and found that fire and windstorms were major factors affecting plant community composition. It is not known to what extent these factors have affected lowland vegetation, as the original composition of the floodplain has not been well documented. Periodic floods undoubtedly affected those early forests. Recent studies revealed that pioneer species of the floodplain have greatly decreased in numbers because of changes in river hydrology due to dam construction (Howe & Knopf 1991, Bragg & Tatschi 1977). It is not known to what extent dams on the upper reaches of the Chippewa River have altered downstream vegetation. Our research had several objectives: 1) to document the extent and composition of the vegetation of this river valley at the time of settlement (ca. 1850); 2) to investigate whether elevation level and disturbance are environmental factors responsible for the composition of the early communities; and 3) to provide a background for understanding the development of contemporary vegetation

essential for investigations into the effect of dam construction and other human activities on the floodplain vegetation.

METHODS

The original land survey was conducted along the lower Chippewa River between October, 1848, and May, 1850. Microfilm copies of the original field notes were used to reconstruct the presettlement vegetation using methods described by Cottam (1949), Goder (1956), and Bourdo (1956). Surveyors recorded major changes in the vegetation, trees that occurred directly on the line, the presence of rivers, streams, abrupt topographical changes, and other features. They also recorded a brief description of each mile they traversed. In addition to the section and quarter section points, surveyors established points on both banks whenever they crossed the river and cited them with directional distance to the nearest two trees (witness trees). We transcribed the location of individual tree species, diameters, and distances from all survey points to large gridded maps of the area. These maps were used to calculate the frequency of occurrence, relative density, and average diameter of the trees at the survey points. The boundaries of the three major vegetation types were determined qualitatively by inspection of the gridded map and by noting comments of the surveyors (Figure 1). A polar planimeter was used to estimate the percent cover for the vegetation types.

RESULTS

A total of 387 original survey points was examined and a total of 649 trees was recorded. Sixteen percent of the points (63) had no witness trees as they apparently occurred in open areas. Vegetation along the 97 km reach of the lower river was divided into three vegetation types: 1)prairie/oak savanna, 2)oak forest, and 3)bottomland hardwoods. Oak savannas were defined by Curtis (1959) as areas in which trees occurred but were more than 15 m apart. Oak savannas occurring at higher elevations (>5 m) were combined with prairies because of difficulty in distinguishing between the two from the surveyors' records. These open areas can also be recognized from the section line descriptions written by the surveyors. They included "level prairie bottom," "scattering bur oak," and "rolling prairie land." Oak forests were also located on the higher (>5 m) and less flood prone terraces. Surveyors described them as "second rate land with good oak timber" and "well timbered with oak." The bottomland hardwood forest was located on the lowest terrace (<5 m). Surveyors typically described section lines in this forest type as "elm and maple timber," "timbered with birch, maple and elm," and "level marshy land."

Prairie/Oak Savanna

The majority of the prairie/oak savanna occurred on the upper one-third of the reach, in Eau Claire and Dunn Counties. The first written description of this area was given in 1767 by Jonathan Carver as follows: "The country adjoining the river, for about sixty miles is very level, and on its banks lie fine meadows, where larger droves of Buffalo and Elks were feeding than I observed in any other part of my travels" (Curtis 1959). Early local newspaper accounts describe the vegetation as "mostly prairie, slightly rolling, and interspersed with an abundance of fine timber." In an early Natural History Survey, botanist E.M. Hill

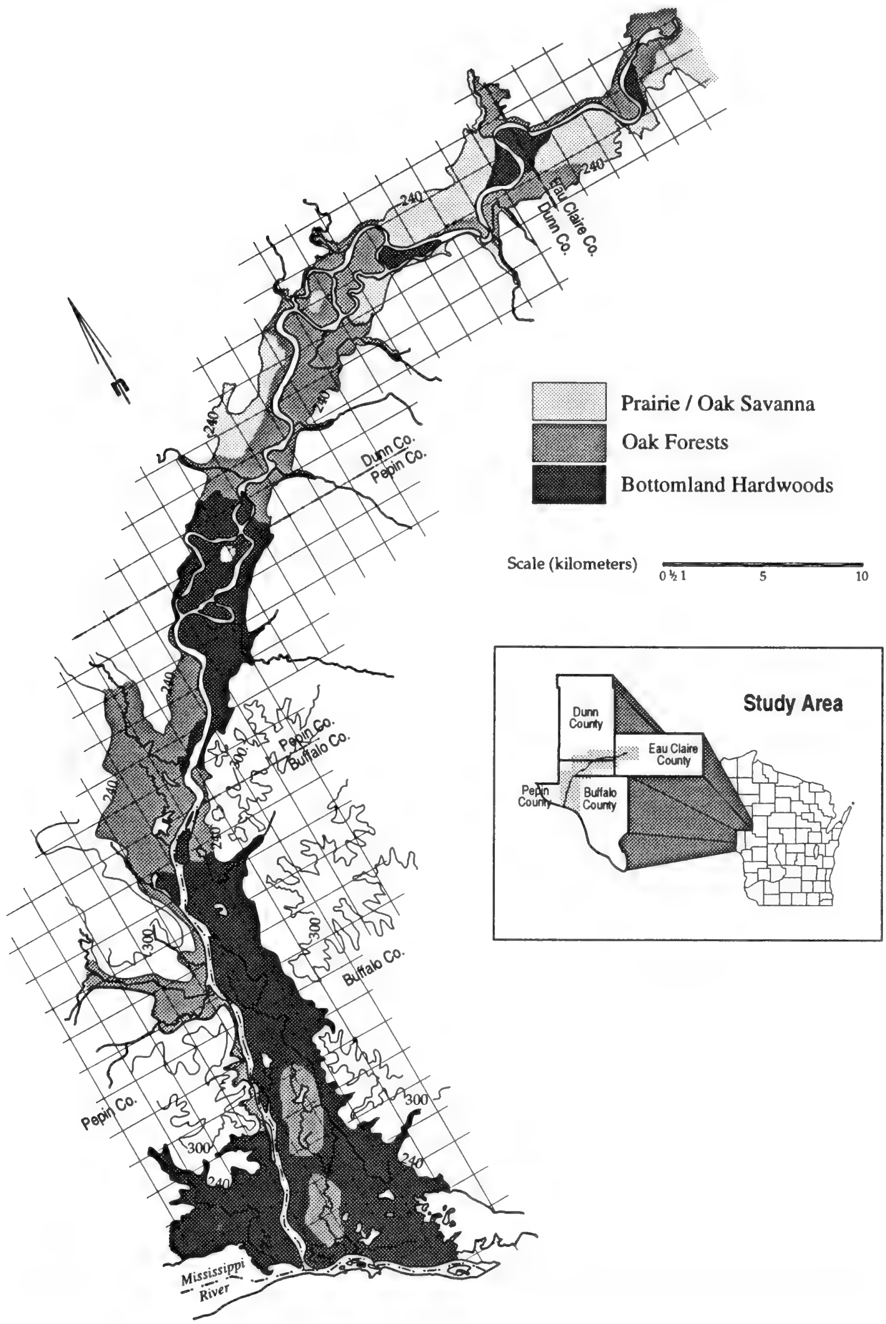

FIGURE 1. The pre-settlement vegetation of the lower Chippewa River between Eau Claire and the Mississippi River. The contour interval is in m.

stated, "In Dunn County patches of prairie and strips of terrace are found in nearly every township," (Wooster 1877).

This reach lies within the Central Plains of Wisconsin, a relatively low landscape with little local relief. Here the river is narrower than downstream and is characterized by small narrow bands of floodplain hardwoods on the lowest terraces (<5 m). The prairies and oak openings occupied the more extensive upper terraces where the soil is an "excessively drained sand and loamy sand" (Thomas 1977). Sixteen percent of the valley was listed as non-forested (i.e. prairie and oak savanna). Only five tree species were recorded by the surveyors in this vegetation type and species of oak accounted for about 76.5% of all trees (Table 1). Bur oak (*Quercus macrocarpa*), with a relative density (percent of total density of all species) of 52.9%, was the most abundant, while white oak (*Q. alba*) (11.8%) and black oak (*Q. velutina*) (11.8%) were also common along surveyors' transects. The surveyors used the entry "black oak," but we believe this was also meant to include all species in the "black oak" group (i.e. *Q. borealis, Q. ellipsoidalis*, and *Q. velutina*)(Curtis 1959). All three species are presently abundant and were probably also abundant at the time of the original survey in ca. 1850. Tans (1976) stated that there may have been a bias on the part of the surveyors for selecting oak as a bearing tree because of its great longevity. We believe this was not an important bias for our study because of the limited choice in tree species. In any case, it appears that oak species were by far the most abundant tree in this open vegetation type.

Oak Forest

Oak forests comprised about 43.4% of the pre-settlement vegetation. They occurred along the higher terraces where the soils are primarily well-drained

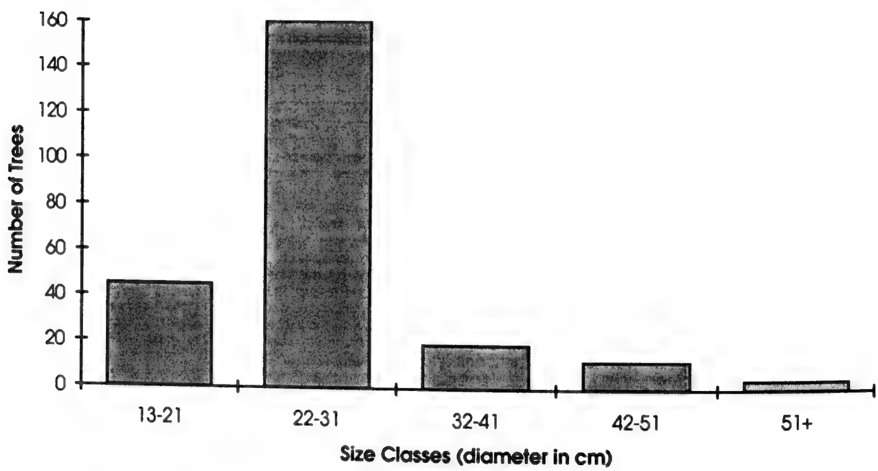

FIGURE 2. Trees of the oak forest vegetation type grouped into size classes.

TABLE 1. Frequency of occurrence, relative density, and average diameter of tree species found within the prairie/oak savanna vegetation type.

Species	Freq. (%)	Rel. Den. (%)	Avg. Dia. (cm)
Quercus macrocarpa	10.9	52.9	9.3
Ulmus americana	6.5	17.6	12.7
Quercus alba	2.2	11.8	14.0
Quercus spp.[8]	2.2	11.8	9.5
Betula nigra	2.2	5.9	10.0

**Quercus* spp. was listed as "black oak" by the surveyors and may be *Q. velutina, Q. borealis,* and/or *Q. ellipsoidalis*.

TABLE 2. Frequency of occurrence, relative density, and average diameter of tree species found within the oak forest vegetation type.

Species	Freq. (%)	Rel. Den. (%)	Avg. Dia. (cm)
Quercus macrocarpa	44.1	43.0	10.9
Quercus spp.*	31.7	26.4	11.2
Quercus alba	11.0	9.9	12.4
Fraxinus pennsylvanica	6.9	4.1	10.2
Ulmus americana	6.2	4.1	12.8
Betula nigra	6.2	3.7	10.0
Acer saccharinum	4.1	2.1	11.8
Celtis occidentalis	2.8	1.7	10.3
Pinus strobus	2.1	1.7	13.5
Populus spp.	1.4	1.2	11.3
Pinus banksiana	0.7	0.8	10.5
Acer negundo	0.7	0.4	8.0
Carya cordiformis	0.7	0.4	10.0
Tilia americana	0.7	0.4	10.0

**Quercus* spp. was listed as "black oak" by the surveyors and may be *Q veluntina, Q. borealis,* and/or *Q. ellipsoidalis.*

loamy sands and sandy loams (Thomas 1964, Wing 1975). Fourteen tree species were recorded by the surveyors (Table 2), indicating much greater tree species diversity than in the oak openings. Oaks accounted for 79.3% of all trees. Bur oak, with a relative density of 43.0%, was the most numerous species, while black oak (26.4%) and white oak (9.9%) were common.

The mean diameter of tree species in the original oak forest was 27.7 cm. The distribution of size classes for all tree species combined is presented in Figure 2. Size structure graphs for all species in typical forests are often described as "J-shaped" because of the rapid decrease in number of trees when plotted against increasing size classes. Figure 2 does not follow this pattern because of the lack of small trees. The majority of our trees occurred in the 22 to 31 cm size class. This clustering may be due to surveyor bias. Bourdo (1956) found

TABLE 3. Mean distance (m) and standard error of trees from surveyor points for the two size classes in the forests.

	Diameter				
	<22 cm	>22 cm	df	t	p-value
Oak forest	6.1 ± 0.74	8.4 ± 0.33	147	3.039	$p < 0.01$
Bottomland hardwoods	6.0 ± 0.49	5.9 ± 0.28	298	0.432	$p > 0.05$

that surveyors avoided small trees because these were too hard to inscribe. If bias did exist surveyors would likely go farther to obtain medium and large size trees. This would result in a greater average distance from survey points for these size classes. The mean distances from survey points to trees less than 22 cm and to trees 22 cm or greater in diameter were 30.4 links (6.1 m) and 41.9 links (8.4 m), respectively. We found these distances to be significantly different at the $p<0.01$ level ($t=3.039$, 147 df) and, thus, we conclude that bias did exist (Table 3). Tree density was not calculated from the surveyors' records because of their failure to include trees in the <13 cm size class as witness trees and their bias for larger trees. Smaller trees usually represent a substantial portion of the trees present in a forest. Their exclusion results in a serious over-estimate of the mean distance between trees and subsequently a lower absolute density than was actually the case.

Bottomland Hardwoods

Bottomland hardwood forests occurred as small crescent-shaped bands on the upper reaches of this river section. These stands became progressively larger downriver. Extensive tracts of bottomland hardwoods occurred on the floodplain and delta of the Chippewa River at its confluence with the Mississippi River. Our results show that this vegetation type accounted for approximately 41.4% of the presettlement vegetation. Soils consisted of loose river-deposited sand and gravel ("riverwash") near the river's edge, and silty and loamy alluvial soils underlain by sand on the terraces (Thomas 1962).

Eighteen tree species occurred in this vegetation type. Silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), river birch (*Betula nigra*), and American elm (*Ulmus americana*) were the most important species, together comprising about 61.6% of all trees (Table 4). Oak species accounted for a total of only 11.6% of all trees, in contrast to their dominance at higher elevations. Average diameter of all trees was 23.6 cm dbh. The distribution of size classes was very similar to that in the oak forest, with 60.0% of trees in the 22-31 cm dbh class (Figure 3). In this case, we found no significant difference ($p>0.05$, $t=0.432$, 296 df) between the mean distance from the survey points to the smaller trees and to the 22 cm diameter or greater trees (Table 3). Accordingly, we conclude that bias did not exist in the lowland hardwood forest.

TABLE 4. Frequency of occurrence, relative density, and average diameter of tree species found within the bottomland hardwoods vegetation type.

Species	Freq. (%)	Rel. Den. (%)	Avg. Dia. (cm)
Fraxinus pennsylvanica	28.6	17.4	9.9
Acer saccharinum	27.6	16.5	11.6
Betula nigra	23.0	14.6	10.8
Ulmus americana	23.0	13.1	13.5
Quercus macrocarpa	11.2	6.7	10.6
Tilia americana	11.7	6.7	11.2
Celtis occidentalis	10.7	5.9	10.7
Salix nigra	7.7	5.4	6.9
Populus spp.	5.1	3.3	10.5
Quercus spp.*	5.1	2.8	10.1
Carya cordiformis	4.1	2.1	7.8
Quercus alba	3.1	1.8	8.6
Populus deltoides	2.0	1.3	7.4
Juglans nigra	0.5	0.3	8.0
Juniperus virginiana	0.5	0.5	9.5
Acer negundo	0.5	0.3	10.0
Juglans cinerea	0.5	0.3	8.0
Quercus bicolor	0.5	0.3	10.0

**Quercus* spp. was listed as "blackoak" by the surveyors and may be *Q. velutina, Q. borealis,* and/or *Q. ellipsoidalis*.

DISCUSSION

Prairie/oak savanna was an extensive presettlement vegetation type in the lower Chippewa River valley. It was most prevalent on the gentle slopes of the Central Plains on the upper reaches of the river (Eau Claire and Dunn Counties). The dry sandy soils characteristic of this area were presumably not as con-

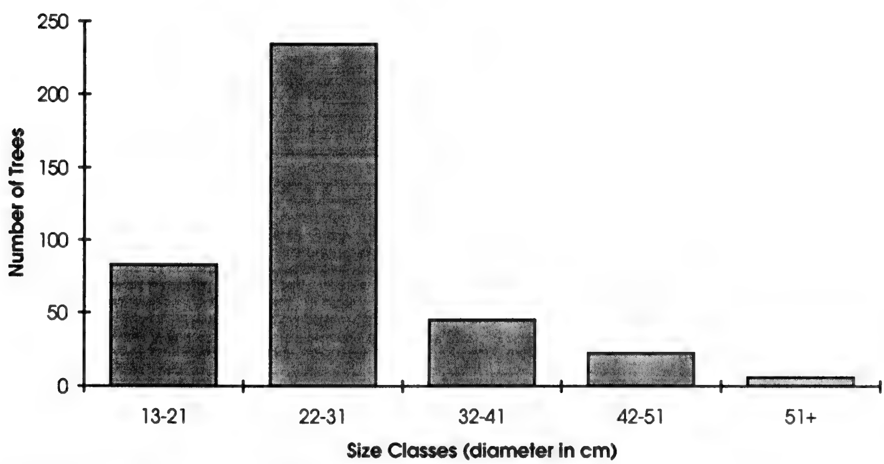

FIGURE 3. Trees of the bottomland hardwoods vegetation type grouped into size classes.

ducive to tree growth as were the heavier soils elsewhere, thus favoring more drought-resistant grasses. Perhaps more important was high wildfire frequency. The presence of large tracts of prairie in the Middle West has been attributed to periodic burning (Gleason 1913). Curtis (1959) described Southern Wisconsin prairies as maintained by periodic fires, and Barnes (1974) concluded that fire was a key element in explaining prairie–savanna distribution in northern sections of our study area.

Flooding in the lower terraces of rivers may also explain treeless conditions (Dinerstein 1979). Dinerstein reported that flooding alone may create savanna-like conditions in river bottoms through sedimentation, waterlogging, and vegetation destruction. All of these influences likely were responsible for the open nature of much of the presettlement vegetation.

Oak forests were more frequent and larger in area on the middle and lower reaches (Pepin and Buffalo Counties) where the river flows through the Western Uplands of Wisconsin. The elevation is higher here, the land more greatly dissected, and the soil less droughty. Oak forests are also maintained by fire, but of less frequent occurrence than that of the oak savanna.

Bur oak accounted for nearly 50% of all trees in the oak forest and was the dominant species of the oak openings. Dominance by this shade-intolerant, fire-resistant species suggests that the delineation between prairie/oak savanna and oak forest is not as distinct as Figure 1 suggests.

The occurrence of so many trees in the 22 to 31 cm diameter class in oak forests appears to be the result of surveyor bias. However, the large number of trees in this size class and so few trees in the >32 cm size classes supports our contention that these forests were not very old when they were originally surveyed.

Bottomland hardwoods occurred exclusively on the low flood-prone terraces adjacent to the river. Erosion and sedimentation are common on the sandy substrate, and result in continuous changes in the river channel and reworking of the lowest terrace substrate. Tree species diversity was high, with 18 species recorded by the surveyors. Silver maple and river birch, abundant species in this vegetation type, are almost entirely confined to river valleys throughout Wisconsin; and green ash, also abundant, grows primarily in western Wisconsin river valleys (Ware 1955). They are colonizing species in bottomland forests, and their abundance attests to repeated disturbance on the lower floodplain environment. Most of the trees were in the 22 to 31 cm diameter class. This apparent "even-age" distribution is frequently associated with natural catastrophes. On these low-lying floodplains, flooding is the most common disturbance. The small size indicates that dominant trees were relatively young, early successional species in this dynamic environment.

CONCLUSION

The presettlement vegetation of the lower Chippewa River valley was a mosaic of prairies, savannas, and forest, with nearly half of the area occupied by

bottomland hardwoods. The open nature of the upland vegetation over a large part of this region indicates the important role fire had in the development of vegetation prior to European settlement. Disturbances along the Chippewa River such as flooding, erosion, sedimentation, and river channel migration maintained a young forest. Our data indicate that there were few, if any, old growth forests on the presettlement floodplain. Consequently both upland and lowland forests were dominated by relatively young, early successional species.

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EDITORIAL NOTICE: LIST OF REVIEWERS

I wish to thank the following individuals, who reviewed papers for Volume 34 (1995). Their volunteer efforts make possible the continued high quality of the papers in this journal.

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NOTEWORTHY COLLECTIONS

ONTARIO and MICHIGAN

ELEOCHARIS NITIDA Fern. (Cyperaceae). Spike-rush.

Previous knowledge. Fernald (1906, 1950) stated that this species ranges from "Newfoundland to southern Alaska, and south, very locally, to Nova Scotia, northern New Hampshire and northeastern Minnesota." Although some recent botanists (e.g. Gleason & Cronquist 1991, Boivin 1992) lump this species with other taxa in the *Eleocharis elliptica* Kunth group, it is morphologically distinctive (P.M. Catling pers. comm. and in prep.). Morton and Venn (1990) rejected it from their Ontario list, but it is known from ten sites in the coniferous forest region of northern Ontario, and is now on the active rare species list for the province (Oldham 1996). No collections had been made in Michigan prior to Voss' (1972) flora.

Significance. Both of the collections reported here extend the known range of the species significantly southward. The southern Ontario collection is from a population about 550 km south of the closest population in northern Ontario, near Lake Abitibi. However, Macoun collected the type from much further south, near Quyon, Quebec (Fernald 1906). The Michigan collections are the first for the state, and although this spike-rush has been searched for in other areas of apparently suitable habitat in northern Michigan, it has not been located elsewhere (A.A. Reznicek, pers. comm.).

Diagnostic characters. Eleocharis nitida is similar to *E. elliptica* and *E. compressa* Sulliv., which also have rhizomes and trigonous achenes which are golden-yellow with a rough cellular surface when mature (Fernald 1950; Voss 1971). It may be distinguished from these species by its small size (capillary culms less than 10 cm tall), lower bracts <1.6 mm long (vs. >2 mm), and quadrangular stem with only 4–5 vascular bundles (vs. 6–15) (P.M. Catling pers. comm., in prep. and see Fernald 1950).

ONTARIO, BRANT CO.: locally abundant along the edge of a shallow, seasonally wet depression in an old borrow pit associated with Town of Paris landfill site (80° 24' W, 43° 12' N), 19 July 1994, *Larson* 3551 (DAO; MICH, !P.M. Catling and A.A. Reznicek). *Carex viridula* Michx., *Equisetum variegatum* Schleich., and *Agalinis tenuifolia* (Vahl) Raf. were the dominant plants in this community; other associates included *Lobelia kalmii* L., *Solidago ptarmicoides* (Nees) Boivin and *Spiranthes cernua* (L.) Rich.

MICHIGAN, SCHOOLCRAFT CO.: wet sandy soil along logging road, 7.5 miles east of Shingleton (86° 20' W, 46° 20' N), 18 June 1984, *D. Henson* 1627 and 10 July 1984, *D. Henson* 1641 (MICH, !A.A. Reznicek). Associates included *Muhlenbergia uniflora* (Muhl.) Fern., *Hypericum canadense* L., *Viola lanceolata* L., *Lycopodium inundatum* L., *Rhynchospora fusca* (L.) Aiton f., and *R. capitellata* (Michx.) Vahl.

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A NEW HYBRID SPECIES, ×*CALAMMOPHILA DON-HENSONII* (*AMMOPHILA BREVILIGULATA* × *CALAMAGROSTIS CANADENSIS*, POACEAE), FROM GRAND ISLAND, MICHIGAN

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A puzzling dune grass first collected in 1991 on the sandy shores of Lake Superior in Michigan's Upper Peninsula (Alger County) in the immediate vicinity of Williams Landing, Grand Island and later on the adjacent mainland has proved to be an intergeneric hybrid between two common native species, bluejoint (*Calamagrostis canadensis* (Michx.) P. Beauv.) and beach grass (*Ammophila breviligulata* Fernald), both of which grow in the same area.

This is apparently the first report of this intergeneric hybrid in the New World. Hybrids between the closely related genera *Ammophila* and *Calamagrostis* have long been known from northern Europe, where two cytological races, 2n = 28 and 2n = 56, of both *A. arenaria* (L.) Link and *C. epigeios* (L.) Roth cross to produce hybrids known as ×*Calammophila baltica* (Flüggé ex Schrad.) Brand. There are actually three ways in which this hybrid has been produced: between the two 2n = 28 parents, and in both permutations between 2n = 28 and 2n = 56 parents (Westergaard 1943, as *Ammophila baltica* (Flüggé ex Schrad.) Link); the hybrid with both parents 2n = 56 has not been reported. All of the hybrids are reported to be sterile. This hybrid genus has been traditionally known as ×*Ammocalamagrostis* P. Fourn. The first author to draw attention to the earlier name ×*Calammophila* Brand was apparently Czerepanov (1981).

In North America north of Mexico there are about 30 species of *Calamagrostis* (Hitchcock 1951, Kartesz 1994). *C. canadensis* is by far the commonest species in Michigan and is the only one known from the Alger County sites where the hybrid was found growing. It is quite complex cytologically, as shown in the detailed studies by Nygren (1954), with chromosome numbers ranging from 2n = 42 to 2n = 66. Bowden (1960), working with field collected material, found only 2n = 42 and 2n = 56 in eastern North American material. He found only 2n = 56 in Great Lakes region plants, but his sample was small and included no plants from the Lake Superior drainage.

Ammophila is represented in North America by one or two native species (depending on the recognition of *A. champlainensis* F. Seym.) and one introduced species (*A. arenaria* (L.) Link, used on the Pacific coast and rarely on the Atlantic coast as a sand binder). Only *A. breviligulata* is known from Michigan

and the Great Lakes region (Guire & Voss 1963), and it also occurs along the Atlantic coast. *Ammophila breviligulata* has a simple chromosome situation in eastern North America, with Great Lakes and Atlantic Coastal populations both being 2n = 28 (Bowden 1960). A collection from Lake Champlain, from among populations later separated by Seymour (1966) into his *A. champlainensis*, was also reported by Bowden to be 2n = 28. One of the collections examined by Bowden (1960) was from Lake Superior.

It is our pleasure to name this new grass after Don C. Henson of Manistique, Michigan, one of its co-discoverers. Don is the premier field botanist in Upper Peninsula history and an uncompromising defender of its biological integrity.

×*Calammophila don-hensonii* Reznicek & Judz., hybr. nov. TYPE: MICHIGAN: Alger County: Grand Island, Williams Landing, along shore in section 22, T47N, R19W, south shore of Island ca. 5 1/4 km NW of Munising; low dunes above upper beach of Lake Superior, with sparse *Ammophila* in essentially bare sand, 9 July 1991, *A.A. Reznicek 8827, D. Henson, J. Henson, & D. Tiller* (holotype: MICH).

Gramen perenne iter *Ammophila breviligulata* et *Calamagrostis canadensis* intermedium, 60–100 cm altum, rhizomatosum, glabrum. Laminae 25–35 cm × 4–7 mm, firmae, supra dense scabrae. Inflorescentia 13–25 × 2–3 cm, densa. Spiculae uniflorae, ovati-lanceolatae; glumis equalibus, 5.8–7.1 mm longis, glabris, 1–3-nervis; lemmate 4.8–6.1 mm longo, 5–7 nervis, pilis callis 3.1–4.6 mm longis, arista dorsali stricta 0.6–1.7 mm longa e costa paullo infra- apicali prodienti. Stamina 3, antheris 2–3 mm longis.

Perennial 60–100 cm tall, with scattered tufts produced from elongate rhizomes. Foliage glabrous; leaf sheaths stramineous and shiny near base; culms scabrous just above the nodes; summit of leaf sheath often with a small, yellowish-brown collar; ligules 3–8 mm long, firmly membranous; blades 25–35 cm long, 4–7 mm wide, coarse, slightly involute, very scabrous above (adaxially). Peduncle 10–20 cm long, smooth. Inflorescence 13–25 cm long, 2–3 cm wide, densely-flowered, the short branches strongly ascending and antrorsely hispid-scabrous. Spikelets 1-flowered, ovate-lanceolate, somewhat laterally compressed, stramineous or slightly flushed with purple near glume and lemma tips, glabrous, bearing a dense beard of straight callus hairs 3.1–4.6 mm long; glumes equal, 5.8–7.1 mm long, folded width 0.6–0.8 mm, lanceolate-elliptical to lanceolate-ovate, acute, keeled, scabrous on the nerves or across the back, the lower glume 1–(3)-nerved, the upper 3-nerved; lemma 4.8–6.1 mm long, lanceolate, finely 5–7-nerved, with a delicate, straight awn 0.6–1.7 mm long produced from just below the apex of the midrib at the tip, 3.7–4.7 mm from the base; palea 4–5.5 mm long, bicarinate. Caryopsis (rarely formed) 2 mm long, 0.8 mm wide, ellipsoid-pyriform, the embryo 0.4 mm long, the hilum linear-elliptical, evident only in the lower half. Stamens 3, the anthers 2–3 mm long,

mostly shrivelling and apparently not dehiscing. Chromosome number unknown.

Paratypes: Alger Co., Grand Island: Sec. 22, T47N R19W, in sandy soil at Williams Landing, 6 August 1991, *Henson 3433-A* (MICH); near Williams Landing, along road just west of USFS storage building, 14 August 1991, *Henson 3454* (WIS); near Williams Landing, on southmost point of the Island, south of barge dock, 14 August 1991, *Henson 3455* (MICH); Alger Co., north center of Sec. 27, T47N R19W, Oscar Froberg's Landing [on mainland opposite Williams Landing], along shore of lake Superior in semi-stable sand, 17 July 1991, *Henson 3393* (MICH).

Although the two parents differ in many macroscopic characters (Table 1), this hybrid is quite uniformly intermediate. The growth habit is superficially like that of *Ammophila breviligulata*, with culms separated by long rhizomes, but the shoots are often in tufts of several together, rather than usually solitary

TABLE 1. Comparison of morphological characters of *Calamagrostis canadensis*, ×*Calammophila don-hensonii*, and *Ammophila breviligulata*.

Character	*Calamagrostis canadensis*	×*Calammophila don-hensonii*	*Ammophila breviligulata*
Habit	Dense clones formed by short rhizomes	Tufts of several stems produced from ± elongate rhizomes	Stems produced singly from elongate rhizomes
Height	50–100 cm	60–100 cm	35–60 cm
Leaf texture	Soft, flat, smooth	Intermediate	Coarse, often inrolled, strongly scabrous adaxially
Inflorescence	Loosely pyramidal	Intermediate	Compactly cylindrical
Spikelet in cross section	Terete	Slightly laterally compressed	Strongly laterally compressed
Spikelet (and glume) length	3–4.5 mm	5.8–7.1 mm	8.5–13 mm
Spikelet color	Green flushed with purple	Green to stramineous often with slight purple flush	Stramineous, sometimes with slight purple flush
Glumes	Ovate, acute	Ovate-lanceolate to lanceolate-elliptical, acute	Lanceolate-elliptical obtuse
Ratio of lemma length/callus hair length	0.8–1.2	1.2–1.8	3.4–4.8
Lemma awn attachment and length	From middle of back, 0.7–2 mm from the base; 0.9–2.1 mm long	From near tip, 3.8–4.7 mm from the base; 0.6–1.7 mm long	From near tip, 6–11 mm from the base; 0.1–1.7 mm long

as in *Ammophila*, and are taller, often as tall as those of *Calamagrostis canadensis*. The dense, narrowly ovoid inflorescences of ×*Calammophila* are also striking, being precisely intermediate between the compact, cylindric inflorescences of *Ammophila* and the open, loosely pyramidal inflorescences of *C. canadensis*.

Intermediacy in major spikelet features that especially differ between *Ammophila breviligulata* and *Calamagrostis canadensis* is shown in Figs. 1 and 2. Values in these two figures for the putative parents were derived from single measurements each on twenty specimens of both putative parents collected from the vicinity of Lake Superior (specimens sampled at MICH). Each specimen of the putative hybrid is represented on the figures by five measurements.

Ammophila breviligulata has much longer glumes (8.7–13.2 mm versus 2.9–4.5 mm) and lemmas (8.2–12.5 mm versus 2.3–3.4 mm) than *Calamagrostis canadensis*. The callus hairs of the lemma in *A. breviligulata* are also short and inconspicuous, only ca. 1.8–3.3 mm long, with the lemma being 3.5–4.8 times as long. In *C. canadensis*, the callus hairs are conspicuous. Though only ca. 2.2–3.8 mm long, they are about as long as the lemma (lemmas 0.8–1.1 times as long as the hairs). Figure 1 shows the Grand Island collections forming two distinct groups between the widely separated *A. breviligulata* and *C. canadensis* clusters. *Ammophila breviligulata* also has the small dorsal awn attached much higher up on the lemma (6.7–11 mm from the base) than in *C. canadensis* (0.6–1.9 mm from the base). As in Fig. 1, Fig. 2 shows two widely separated clusters for *A. breviligulata* and *C. canadensis*, with the Grand Island

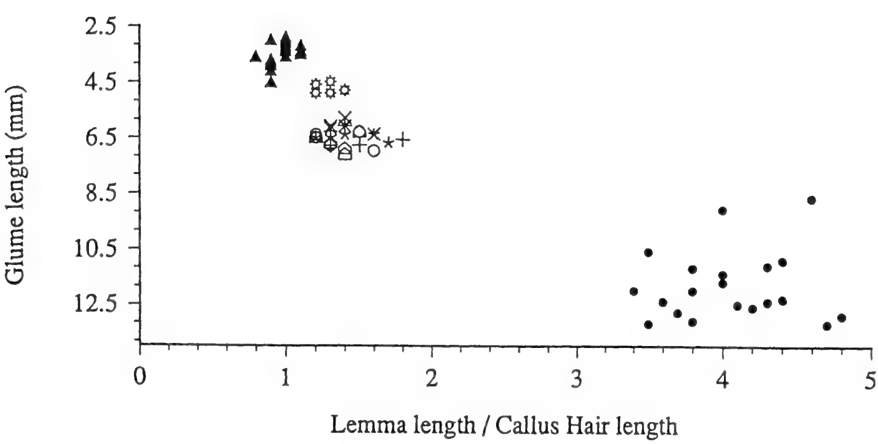

FIGURE 1. Glume length (mm) versus lemma length/ callus hair length in ×*Calammophila donhensonii*, *Ammophila breviligulata*, and *Calamagrostis canadensis*.
• Ammophila breviligulata ▲ Calamagrostis canadensis ○ Reznicek 8827
× Henson 3393 ✪ Henson 3394 ⌂ Henson 3455
⋆ Henson 3433a + Henson 3454

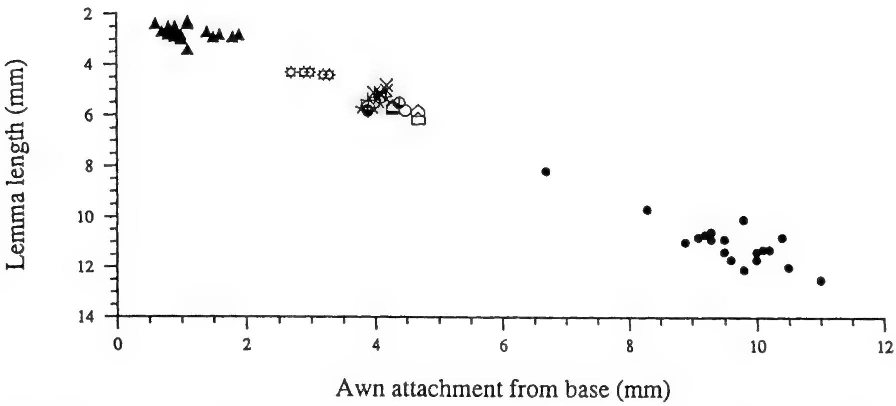

FIGURE 2. Lemma length (mm) versus awn attachment (mm above base of lemma) in ×*Calammophila don-hensonii*, *Ammophila breviligulata*, and *Calamagrostis canadensis*.
• Ammophila breviligulata ▲ Calamagrostis canadensis ○ Reznicek 8827
× Henson 3393 ✪ Henson 3394 ⌂ Henson 3455
⋆ Henson 3433a + Henson 3454

plants forming two smaller, adjacent groups in between. These differences in the lemma lengths, points of dorsal awn insertion, and callus hair length are illustrated in Fig. 3.

In both Figs. 1 and 2, the putative hybrid clusters fell closer to the *Calamagrostis* parent than to the *Ammophila* parent. This is expected, since the *Calamagrostis* parent, having a higher chromosome number, would presumably contribute more genetic material to the putative hybrid. However, cytological studies on the hybrid and its backcross would be desirable, especially to determine which chromosome race of *C. canadensis* was involved in the cross.

Except for *Henson 3394* (Alger Co., north center of Sec. 27, T47N R19W, Oscar Froberg's Landing [on mainland opposite Williams Landing], along shore of Lake Superior in semi-stable sand, 17 July 1991 (MICH)), the different collections are all very similar to each other, sufficiently so as to suggest that they may all represent a single clone. *Henson 3394* is intermediate in all ways between ×*Calammophila don-hensonii* and *Calamagrostis canadensis*, forms its own group on Figs. 1 and 2, and is presumed to be a backcross. Measurements from this specimen were not included in the description of the hybrid. Though most florets of the putative hybrid were sterile, a few bore seemingly normal (and presumably viable) caryopses, which would explain the occurrence of this putative backcross.

ACKNOWLEDGEMENTS

We are very grateful to Steve Darbyshire (DAO) for his thoughtful and very helpful comments on our manuscript, to Susan Reznicek for drawing Figure 3, and to Werner Greuter (B) for nomenclatural comments on ×*Calammophila* Brand.

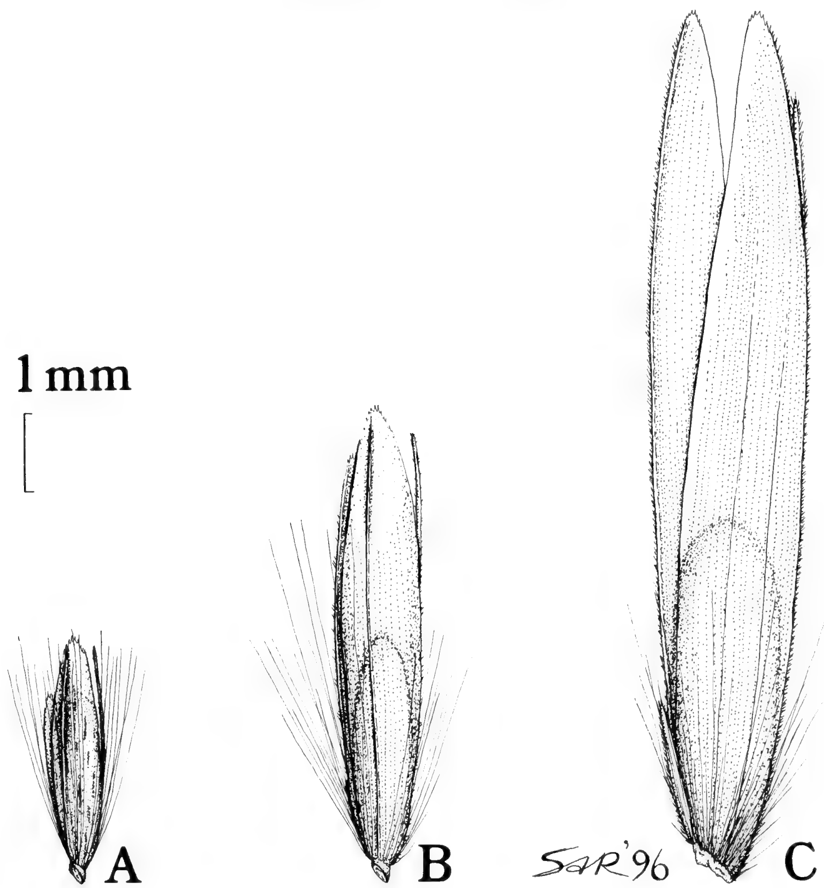

FIGURE 3. A. floret of *Calamagrostis canadensis* (drawn from Etter 282, MICH); B. floret of ×*Calammophila don-hensonii* (drawn from Henson 3455, MICH); and C. floret of *Ammophila breviligulata* (drawn from *Etter 312*, MICH).

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REVIEW

MICHIGAN FLORA. Part III, Dicots, Pyrolaceae–Compositae. Edward G. Voss. Cranbrook Institute of Science Bulletin 61 and University of Michigan Herbarium. 1996; xix + 622 pages. [ISBN 87737-040-0] $15.00 + shipping and handling, from Cranbrook Institute of Science, 1221 North Woodward Avenue, P.O. Box 801, Bloomfield Hills, Michigan 48303 (810.645.3239 or 810.645.3203 for credit card orders).

Anyone reading this review is going to buy a copy—that's a given. Anyone who sees it on a shelf, with its elegant, glossy dustjacket featuring a full-color photograph of *Tanacetum huronense* on the front, a much smaller photograph of the author on the back, is going to buy it, because it is such a bargain. Flower lovers will buy it because there are 8 plates in full color, along with a very ample number of black-and-white drawings.

Everyone concerned with the flora of the western Great Lakes (the volumes are useful far beyond Michigan's borders) will buy it, because it is a necessary reference—you simply have not done your homework until you've checked out what Voss has to say, because you *know* he's done his homework. [A 1991 announcement in Michigan Botanist 30(2): 48 informs us that Parts I and II are still available from University of Michigan Herbarium at the address above, for $14 apiece, $16 for non-U.S. orders.]

The keys work; everyone who has experienced Parts I and II knows that. There's a special, added treat covering pages 547 through 585: general keys to families and and sometimes genera covering all three books. When you get to the family, or genus, the keys give you part number and page number! How many books are there out there which fail to tell you where to look next?

The index is most thorough: both common names and Latin names are given, in a *single* index, I am happy to say; maps for species are indicated; species illustrations are indicated with an asterisk. One problem is that each part is indexed separately, and there's no index to all three. The solution is obvious, but how many more trees would have to die to print all that? With Anton Reznicek, Voss is now working on a one-volume manual, to sum up and condense the three parts, and there a common index will surely appear. Meanwhile, Richard Rabeler is revising Gleason's *Plants of Michigan*, ed. 3, 1939 (see Michigan Botanist 34(4): 149. 1996 ['October, 1995']).

There are innumerable gems buried in this volume: on page 382 alone, you will discover what *Bidens* has to do with hatchery-reared salmon (with a full-scale reference cited), and that *Bidens* is Latin for a two-toothed hoe. Where on earth did he dig *that* one up? Anyway, Voss' point is that the name is masculine gender, and therefore he has changed the adjectival epithets to agree in gender with the noun they modify. Even Merritt Lyndon Fernald, author of Gray's

Manual, 8th edition, a botanist firmly grounded in classical studies, never ventured this far. (If the derivation is from a compound *bi* + *dens*, referring to the two tooth-like pappus awns, the name is still masculine gender, and to maintain the common practice of treating it as feminine will require conservation—as usual, Voss has it right.)

Chromosome numbers are not given. The reason is simple: the subtitle of the work is "A guide to the identification and occurrence of the native and naturalized seed-plants of the state." Chromosome numbers are no aid to identification. Voss resists the currently fashionable pattern, and I applaud. Chromosome numbers may be of significance in deducing evolutionary patterns, but such matters are not the point of this book.

When a species is illustrated, it is clearly indicated; however, the page number where the illustration appears is not given. But not to worry: I found no illustration farther away than five pages from the reference to it (and most are within two pages), an arrangement over which the author must have labored mightily.

The introduced species are treated as thoroughly as the native elements. This fills a major gap, because the current manuals that cover this part of the world often scant the very plants that many of us encounter most often.

"Naturalized" implies self-reproducing establishment, but Voss is not picky on this point—he includes, for example, *Phacelia tanacetifolia*, known from a single Michigan collection (in 1904) outside of cultivation. The plant is a weed in fields where wild bird seed is grown in southern California, and with the recent explosion of interest in feeding wild birds, it can be expected to show up here and there, as it has (once) in my own town.

Arthur Cronquist (22 March 1992) reviewed Part I in Michigan Botanist 11(4): 213–214. 1972, and Part II in 25(2): 56. 1986. I find myself in very, very good company. Like me, Arthur would have rejoiced at the publication of Part III. He might have fussed a bit at Voss' use of the Englerian arrangement, as he did in both earlier reviews, but once you've begun that way you pretty much have to continue in the same pattern.

Below the color photograph of the author on the back of the dustjacket, there is a capsule biography. This is *not* repeated within the covers of the book. Take steps to save it now. Librarians regularly destroy dustjackets, or use them to make displays. Please don't. From the back of the dustcover, one learns that Professor Voss is now Professor Emeritus of Botany—emeritus means literally "having served one's time as a soldier," and by extension "honorably retired." He has indeed served honorably; he is not truly retired.

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SAGINA JAPONICA (CARYOPHYLLACEAE) IN THE GREAT LAKES REGION

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Sagina japonica (Sw.) Ohwi, Japanese pearlwort, is a native of eastern Asia which has only been collected at a few sites in eastern North America. Specimens gathered from lawns and roadsides in Connecticut, Massachusetts, New York, and Pennsylvania as early as 1941 as cited by Mitchell and Tucker (1991) are the first collections from the eastern United States; additional Pennsylvania collections are mapped by Rhoads and Klein (1993). Rabeler and Thieret (in press) report a single 1992 collection from St. John's, Newfoundland. Within the Great Lakes Region, the only previous collection was made by Groh in 1942 at the Dominion Arboretum at Ottawa, Ontario (Crow 1978); the species is not listed in recent checklists for the Ottawa-Hull Region (Gillett & White 1978) and Ontario (Morton & Venn 1990).

Sagina japonica is now known in northwestern Ohio and from a second site in southern Ontario from the following collections:

CANADA. ONTARIO. YORK REGIONAL MUNICIPALITY: with *S. procumbens* in sidewalk cracks, Bathurst St., one block S of Bloor St., Toronto., 1 July 1995 *Larson 3904* (MICH).

USA. OHIO. LUCAS CO.: in moss patches and sandy disturbed areas under oaks, Meadowview Picnic Area, Secor Metropark, 0.8 km N on Tupelo from Bancroft Rd., Richfield Twp., 21 May 1987, *Cusick 26433* (MU); 15 June 1995, *Reznicek 10034 & Munger* (MICH, OS); 25 June 1996, *Rabeler 1246* (MICH, NHA, + two sheets to be distributed).

Sagina japonica superficially resembles (and sometimes grows with) *Sagina procumbens* L.(procumbent pearlwort), a Eurasian plant sometimes found in sidewalk cracks, roadsides, and lawn edges in the Great Lakes region. It might also suggest *S. decumbens* (Elliott) Torrey & A. Gray subsp. *decumbens* (annual pearlwort), found in the Great Lakes region in sandy areas of southern Ohio, Indiana, and central and southern Illinois (Crow 1978) and reported from Ontario (Morton & Venn 1990). *Sagina japonica* can be distinguished from both species via the following key:

1. Plant perennial, stems procumbent, trailing; flowers mostly 4-merous; sepals diverging from the dehiscent capsule; plant entirely glabrous; seeds brown, triangular, with a dorsal groove . . . . *S. procumbens*
1. Plant annual, stems erect or ascending; flowers mostly 5-merous; sepals remaining appressed to the dehiscent capsule; calyx bases and pedicels often glandular pubescent; seeds light or dark brown, triangular or obovoid to globose, with or without a dorsal groove 2

2. Flowers 5-merous; calyx bases, pedicels, and upper stems glandular pubescent; capsule globose; seeds dark brown, obovoid to globose, lacking a dorsal groove, the surface composed of cogwheel-shaped cells, smooth to pebbled or tuberculate. . . . . *S. japonica*
2. Flowers (4) 5-merous; calyx bases and pedicels glabrous or glandular pubescent, upper stems glabrous; capsule ovoid; seeds tan, triangular, with a dorsal groove, the surface covered with fine reticulate ridges (see Crow 1979 for photo) with or without small tubercles . . . . *S. decumbens*

Although tiny (0.3–0.5 mm long), the seeds are quite distinctive. The seed shape and presence/absence of dorsal grooving are used by Crow (1978, 1979) to divide *Sagina* into two sections. The variation in *Sagina japonica* seed surface texture noted by Mitchell and Tucker (1991) is also exhibited in these collections; the seeds from the Ontario collection are densely covered with knob-like tubercles, while seeds from the Ohio population appear almost smooth or slightly pebbled, exhibiting low rounded bumps.

Sagina japonica should be expected in Michigan and other states in the region, quite possibly in urban areas or at sites similar to those at Secor Metropark. Brief attempts to locate *S. japonica* in Michigan in 1996 in the moss at the base of large oak trees in parks in Monroe and Jackson counties resulted in locating populations of *S. procumbens*. These populations are themselves new records; published maps showing the distribution of *S. procumbens* in the Lower Peninsula of Michigan show records from three counties; Calhoun and Washtenaw in Voss (1985) and Wayne in Crow (1978).

ACKNOWLEDGMENTS

I thank Garrett Crow for confirming the identification of *Rabeler 1246*, Michael Oldham for supplying the Ontario collection and the collection date for Groh's collection of *S. japonica*, Anton Reznicek for bringing *Sagina japonica* to my attention after he collected it in Ohio, and Michael Vincent for the loan of Cusick's collection. Anton Reznicek and Garrett Crow kindly reviewed this manuscript.

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NOTEWORTHY COLLECTIONS

MINNESOTA

Significance. One species of chytrid fungus (Class Chytridiomycetes, Order Chytridiales) and seven species of rust fungi (Class Basidiomycetes, Order Uredinales) are reported here for the first time from Minnesota. 212 rust species are now known from this state. By comparison, 159, 197, and 258 rust species are known from Indiana, Michigan, and Wisconsin, respectively (McCain, unpublished). Rust fungi are obligate parasites of vascular plants, and many have a several-stage life cycle, producing aecia, uredinia, and telia. Some chytrids are also plant pathogens, and their sporangial sori may be mistaken for the aecial sori of rust fungi.

Herbaria consulted. The two major depositories of rust fungi in the United States are the Arthur Herbarium (PUR), Purdue University (records summarized in Arthur 1934, updated in Cummins & Stevenson 1956, Cummins 1962) and the National Fungus Collections (BPI), U.S.D.A., Beltsville, MD (records in Farr et al. 1989); specimens in the herbaria of the College of Biological Sciences (MIN) and the Department of Plant Pathology (MPPD), University of Minnesota, were also checked. Other key references include previous Minnesota and Canadian lists (Conners 1967; Ginns 1986; McCain 1990; Preston & Dosdall 1955). Some specimens were found on vascular plant collections in MIN. All fungi were identified by this author.

CHYTRID FUNGI

SYNCHYTRIUM SHAWII J.S.Karling (Synchytriaceae).

Previous knowledge. Only one previous collection of this fungus is known. It was described by Karling from a herbarium specimen of the host species, *Androsace occidentalis* Pursh (Western rock jasmine, Primulaceae), that had been collected at Northville, South Dakota, 29 May 1935, by J.F. Brenckle (herbarium of Washington State University, WSP-38539).

Diagnostic characters. The newly-recognized specimen had been stored under *Puccinia* sp. indet. as a probable rust fungus, because the sori superficially resemble aecia. However, instead of aeciospores, about 5 resting spores are produced per sorus. The galls result from hypertrophy of a host cell, which invaginates at fungus maturity; thus the collapsed cell looks cuplike (hence, aecium-like). The minute galls on a tiny, uncommon plant suggest why *S. shawii* has not been found otherwise.

The only other chytrid reported on *Androsace* is *S. aureum* Schroeter on *A. chamaejasme* in Switzerland. The composite galls of *S. aureum* are readily distinguished from the simple galls of *S. shawii* (Karling 1956, 1964).

MINNESOTA. Minute resting-spore galls on stems, leaves, and sepals of *A. occidentalis.* PIPESTONE CO.: Pipestone, 19 May 1935, *Rosendahl, Moyle, & Nielsen 3002* (MIN-352409). This specimen was collected 10 days earlier and 135 miles southwest of the previous one.

RUST FUNGI

PUCCINIA ARENARIAE (Schumach.) G. Wint. (Pucciniaceae).

Previous knowledge. The fungus was previously known in Wisconsin on *Arenaria stricta* Michx. [var. *stricta*?] (Rock sandwort, Caryophyllaceae).

Significance. Arenaria stricta var. *litorea* (Fern.) Boivin (Sandwort - only variety listed in Minnesota by Ownbey & Morley 1991) is a new host taxon for this fungus. However, previous occurrences may have been lumped under *A. stricta sensu lato.*

Diagnostic characters. The only other rust fungus on *Arenaria* in North America, *P. tardissima* Garrett from the Rocky Mountains, has shorter, broader teliospores with the spore wall not thickened at the apex as much as in *P. arenariae.*

MINNESOTA. Telia on *A. stricta* var. *litorea*. GOODHUE CO.: Cannon Falls, June 1881, *Sandberg* (MIN-108054).

PUCCINIA BRACHYPODII-PHOENICOIDIS Guyot & Malencon var. *DAVISII* Cummins & H.C. Greene (Pucciniaceae).

Previous knowledge. This variety was described from Ashland, Wisconsin. The previous report from Minnesota (Preston and Dosdall 1955, as *P. pygmaea* Erikss.) was in error (McCain 1990).

Diagnostic characters. Of the seven species of rust on *Oryzopsis* spp. in North America, only this one has paraphysate uredinia (Cummins 1971).

MINNESOTA. Uredinia and telia on *Oryzopsis asperifolia* Michx. (Rough-leaved mountain-rice, Poaceae). PINE CO.: near Willow River, 25 August 1992, 10 October 1993, *Groth* (MPPD-40552, MPPD-40553).

PUCCINIA MARYLANDICA Lindr. (Pucciniaceae).

Previous knowledge. Previous collections had closely bounded Minnesota: on *Sanicula marilandica* L. (Maryland black snakeroot, Apiaceae) from Douglas Co., Wisconsin (PUR-32479), Decorah, Iowa (PUR-32478), and Brandon, Manitoba (PUR-32466), and on *Sanicula* sp. indet. from Big Stone City, South Dakota (PUR-32488).

Diagnostic characters. The one other rust on *Sanicula* spp. in North America, *P. ligustici* Ellis & Everh., occurs in California and does not produce an aecial stage.

MINNESOTA. Aecia on *S. gregaria* C. Bicknell (Clustered black snakeroot). GOODHUE CO.: near Welch, 03 June 1992, *Kubelik & McCain 2580* (MPPD-40532); HENNEPIN CO.: Bloomington, 18 May 1952, *Call 581* (MPPD-40240).

PUCCINIA OBSCURA J.Schroet. (Pucciniaceae).

Previous knowledge. Although this species is known from Iowa, Michigan, and Wisconsin, the epithet "obscura" helps explain why it was not reported previously from Minnesota. No other rust is reported on *Luzula* in North America. The aecial stage is unknown in North America.

MINNESOTA. Uredinia on *Luzula americana* Raf. (Wood rush, Juncaceae). CROW WING CO.: near Garrison, 03 May 1969, *Moore & Burris 11* (MIN-616602); on *L. multiflora* (Retz.) Lejeune. RAMSEY CO.: Maplewood, 21 August 1992, *McCain 2726* (MPPD-40539); ST. LOUIS CO.: Palmers, 21 July 1947, *Lakela 6941* (MIN-393370).

PUCCINIA SILPHII Schwein. (Pucciniaceae).

Previous knowledge. The fungus has been recorded in one or more surrounding states on *Silphium integrifolium* Michx., *S. laciniatum* L., *S. perfoliatum* L., and *S. terebinthinaceum* Jacq. (Asteraceae).

Diagnostic characters. The black, clustered telial sori of this microcyclic species distinguish it from the orange, waxy telial sori of *Coleosporium helianthi* (Schwein.) Arth. and the whitish aecial cups of *Uromyces silphii* Arth., the other two species potentially present on *Silphium.*

MINNESOTA. Telia on *S. laciniatum* (Compass-plant). BLUE EARTH CO.: near Vernon Center, 08 October 1958, *Moore 24392* (MIN-574821); MURRAY CO.: near Chandler, 26 July 1984, *Leoschke 53* (MIN-775040); on *S. perfoliatum* (Cup-plant). DAKOTA CO.: Burnsville, 03 November 1994, *McCain 3368* (MPPD-40540), 28 September 1995, *McCain 4041* (MPPD-40573); FILLMORE CO.: near Mabel, 11 August 1979, *G.B. Ownbey 6390* (MIN-708327); WINONA CO.: (Winona?, 1890s?), *Holzinger* (MIN-224090).

UROMYCES LINEOLATUS (Desmaz.) J.Schroet. (syn. *U. scirpi* Burrill, Pucciniaceae).

Previous knowledge. Aecia occur on *Cicuta* spp. (Water hemlock, Apiaceae) and *Sium suave* Walter (Water-parsnip); uredinia and telia on *Scirpus fluviatilis* (Torr.) A. Gray and *S. paludosus* Nels. (Cyperaceae) in eastern North America (Savile 1972). No other rust species has been found on *Sium* spp. in North America.

MINNESOTA. Aecia on *Sium suave*. CLAY CO.: Moorhead, 28 July 1958, *Stevens 1964* (MIN-552165); NORMAN CO.: Syre, 26 July 1955, *Moore 22613* (MIN-553952); ST. LOUIS CO.: shore of Prairie River, 20 July 1949, *Lakela 9055* (MIN-416640). No telia on *Scirpus* spp. have yet been found in Minnesota.

UROMYCES SEDITIOSUS F. Kern var. *SEDITIOSUS* (Pucciniaceae).

Previous knowledge. This rust fungus is widespread in the central United States, but it has usually been recorded under the name *U. peckianus* Farlow, which is actually a coastal species producing telia on *Distichlis spicata* (L.) Greene (Seashore-saltgrass, Poaceae; Cummins 1971). *Puccinia subnitens* Dietel also has aecia on *Plantago* spp. in the central United States, and the records of these two rusts also need to be straightened out, probably by cross-inoculation studies. Thus, the assignment here of the aecia to *U. seditiosus* is provisional.

Diagnostic characters. The echinulate urediniospores of *U. aristidae* Ellis & Everh. contrast with the verrucose urediniospores of *U. seditiosus*. The aeciospores of *U. seditiosus* purportedly have thinner cell walls than those of *P. subnitens. U. seditiosus* var. *mexicensis* Cummins & Husain has larger spores and does not occur in the United States.

MINNESOTA. Aecia on *Plantago patagonica* Jacq. var. *patagonica* (Patagonian plantain, syn. *P. purshii* auct. non Roem. & Schult., Plantaginaceae). ANOKA CO.: Coon Creek, 31 May 1935, *Ling* (MPPD-40276); PINE CO.: near Cloverdale, 18 June 1979, *Wheeler 3962* (MIN-708974). Uredinia and telia on *Aristida basiramea* Engelm. ex Vasey (Forktip three-awn, Poaceae). DAKOTA CO.: near Coates, 10 August 1985, *Smith 11049* (MIN-787222); on *A. dichotoma* Michx. var. *curtissii* A. Gray (Poverty grass). HENNEPIN CO.: Minneapolis, 1884, *Upham* (MIN-60773); on *A. tuberculosa* Nutt. (Three-awned grass). HOUSTON CO.: near Houston, 01 October 1962, *Moore 26168* (MIN-585663); SHERBURNE CO.: near Orrock, 27 September 1990, *McCain 2307* (MPPD-40554); Zimmerman, 08 July 1986, *Dana 86027* (MIN-792931); WABASHA CO.: Wabasha, 21 September 1945, *Moore 18248 & Dahl* (MIN-442084).

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EPILOBIUM HIRSUTUM (ONAGRACEAE) IN WISCONSIN

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Stuckey (1970) has chronicled the steady migration westward of *Epilobium hirsutum* L. from its first known North American occurrence at Newport, RI, in 1829. This introduced rhizomatous perennial is easily identifiable by its lavender or pink petals 10–15 mm long, clasping leaves, and much-branched stems regularly a meter tall. The known range is from southern Quebec and southern Ontario south of southern Maine, Massachusetts and Maryland, westward to northern Ohio, Michigan, Indiana, and northeastern Illinois (Stuckey 1970, Gleason & Cronquist 1991).

Herbarium vouchers for its occurrence in Wisconsin are as follows, in chronological order, the label data paraphrased, the herbarium abbreviations following Holmgren et al. (1990):

KENOSHA CO.: south of the city of Kenosha, at Carol Beach [a mile N of the Illinois border], SE corner of 116th Street (Tobin Road) and 3rd Court, sec. 32, T1N, R23E, a single plant in a roadside ditch, *Schulenberg 76-400 & Hedborn*, 29 Jul 1976 (MOR, photocopy in OSH); KENOSHA CO.: along C&NW railroad tracks near 116th Street (Tobin Road), sec. 31, T1N, R23E, substantial colony east of the railroad on the south side of Tobin Road, in moist ground, *Swink et al. 10, 280*, 14 Aug 1990 (MOR, photocopy in OSH); MANITOWOC CO.: shore of Lake Michigan in Manitowoc, in riprap around the marina, numerous plants present, sec. 20, T19N R23E, *Thomas s.n.*, 5 Aug 1991 (OSH); MANITOWOC CO.: north end of the yacht harbor on Lake Michigan in Manitowoc, sec. 20, T19N, R23E, *Harriman s.m.*, 8 Aug 1993 (OSH, WIS); MANITOWOC CO.: in riprap along Lake Michigan shoreline, Point Beach State Park, sec. 9, T20N, R25E, *Thomas s.n.*, 15 Aug 1993 (OSH).

The first-cited Kenosha County specimen is the basis for the locality shown on the distribution map in Swink & Wilhelm (1979); the authors made no mention that this was the first record for Wisconsin, even though Ugent (1962) had not credited the species to Wisconsin. Gleason & Cronquist (1991) overlooked or ignored the record; ranges of weedy species in this book are mostly given in a somewhat generalized manner. The Kenosha County occurrence is of course repeated in Swink & Wilhelm (1994). Inquiries to MIL, UWM, and WIS failed to reveal any further records for Wisconsin.

Because the plant occurs in lakeshore riprap in Manitowoc County, I searched from Kewaunee County southward through Manitowoc and Sheboygan counties to Port Washington in Ozaukee County, just north of Milwaukee. This survey revealed no further populations of the species.

The known distribution of the species is spotty, suggesting a pattern of multi-

ple introductions into Wisconsin. I therefore telephoned the city engineer of Manitowoc, Mr. Michael Hawley, to ask for details of the construction of the harbor and marina. The harbor was constructed in the late 1800s; the marina was constructed in 1988–1989 with local materials from Manitowoc County by a contractor from Frankfort, Benzie County, Michigan, where the plant is known to occur (Voss 1985). Perhaps seeds were present in the contractor's equipment.

Voss (1985) mapped the plant for nine Michigan counties abutting Lake Michigan. To this may be added a tenth county:

MACKINAC CO.: along the shore of Lake Huron at Detman's Motel, in St. Ignace on I-75, *Pucker 1208*, 1 Sep 1970 (OSH); MACKINAC CO.: large clump, the stems over a meter tall, in sand, muck, and gravel over limestone at water's edge, Lake Michigan shore, ca. 200 yards west of the north end of the Straits of Mackinac Bridge, Harriman 1987, 4 Aug 1993 (MICH, OSH).

Harriman surveyed likely lakeshore habitats in Michigan's Upper Peninsula from Mackinac County west to the Wisconsin border, but failed to detect any further populations of the species. Moreover, the species has apparently not yet colonized North and South Fox Islands (Hazlett 1993), nor a number of other Lake Michigan islands (Forzley et al. 1993), even though seed sources are nearby and habitats suitable for colonization are available.

ACKNOWLEDGMENTS

I thank the curators at MIL, MOR, OS, OSH, UWM, and WIS for their many courtesies.

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THE BIG TREES OF MICHIGAN
14. Gleditsia triacanthos L.

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The largest known Honey Locust in Michigan is located in the city of Grosse Ile in Wayne County of Michigan's lower peninsula.

Description of the Species: The Honey Locust is a member of the Caesalpinia family, Caesalpiniaceae (Gleason & Cronquist 1991). Some systematists place it in the Legume family, Leguminosae (Voss 1985, Barnes & Wagner 1991). Voss (1985) lists only one species of *Gleditsia* in his *Michigan Flora. Gleditsia* species have flowers arising with the leaves from spur-branches (See Fig. 1). The male inflorescence is a many-flowered pubescent raceme. Female flowers are found in slender few-flowered racemes on the shoots of the previous season. The branches of the tree have conspicuous thorns, although some horticultural varieties lack thorns. Leaves are alternate, pinnately or bipinnately compound, lacking end leaflets. The leaflets are lanceolate-oblong, variably serrate, glabrous, dark green above and pale yellowish green beneath. The trunk is characterized by divisions into several large upright branches near the ground.

Location of Michigan's Big Tree: Michigan's largest Honey Locust is located at 24532 E. River Road, Grosse Ile, in the back yard of a gray stone Victorian home. It bears an aluminum Michigan Botanical Club sign indicating its champion status. The tree can easily be reached by taking the Grosse Ile Bridge from Trenton, MI (SW of Detroit) and proceeding across Grosse Ile Parkway to East River Road on the east side of the island.

Description of Michigan's Big Tree: The trunk of the tree splits into three trunks at ground level. One of the trunks is broken off. Cement and a bolt in the main trunk indicate that repairs were made some time ago. One large branch with a circumference of one meter (39″) fell off during the summer of 1992. The interior is rotted and riddled with insects. The circumference of the tree at breast height was measured on October 25, 1992 at 223″ (566 cm) [Diameter = 71″ (180 cm)]. The crown spread was measured at 74′ (22.5 m), substantially less than the 124′ reported by Thompson (1986). The tree is 78′ tall (24 m), much shorter than the 115′ reported by Thompson (1986). Although crown size

[1]Deceased 20 September 1994.

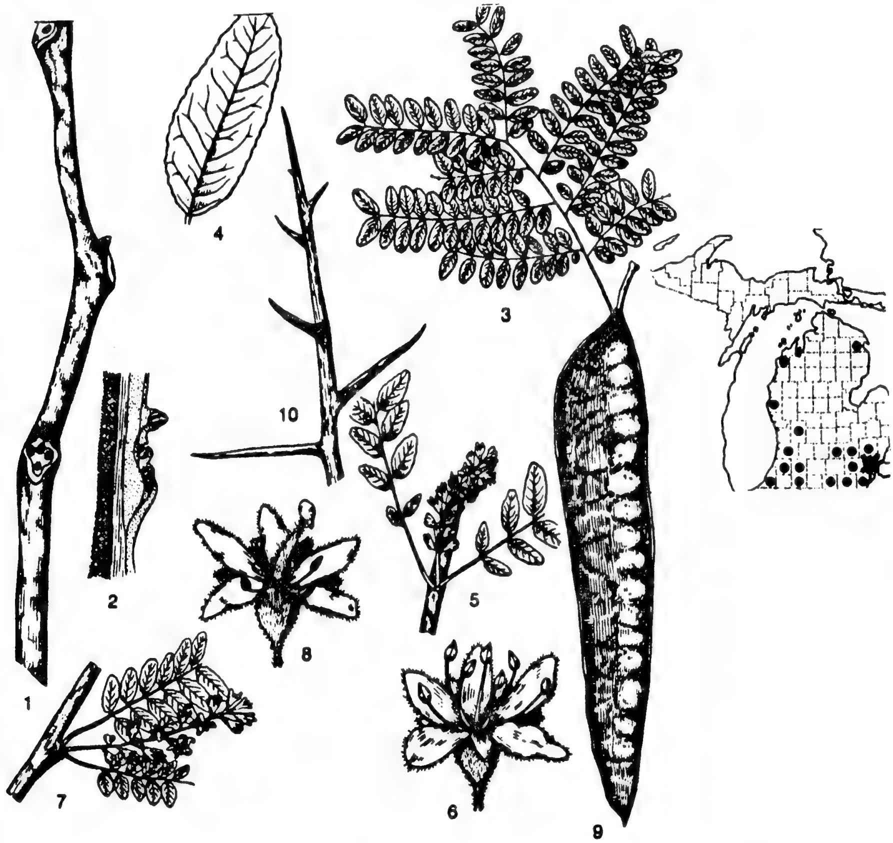

FIGURE 1. Documented distribution in Michigan and characteristics of the Honey Locust. Map is from Voss (1985). The star indicates the location of Michigan's Big Tree. Illustrations are from Barnes & Wagner (1991). 1. Winter twig, ×1; 2. Vertical section through lateral buds, enlarged; 3. Leaf, ×1/4; 4. Leaflet, ×1; 5. Male flowering shoot, ×1/2; 6. Male flower, enlarged; 7. Female flowering shoot, ×1/2; 8. Female flower, enlarged; 9. Fruit, legume, ×1/4; 10. Thorn from trunk, ×1/2.

and height appear to have decreased, its state champion status remains secure because state champion trees are determined by the circumference of the trunk at breast height.

INVITATION TO PARTICIPATE

If you would like to join us in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B. Ehrle for help with locations, specifications for taking measurements, and assis-

tance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property.

LITERATURE CITED

Barnes, B. V,. & W. H. Wagner, Jr. 1991. *Michigan Trees.* A Guide to the Trees of Michigan and The Great Lakes Region. Univ. of Michigan Press, Ann Arbor. viii + 383 pp.

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REVIEW

A CATALOG AND ATLAS OF THE MOSSES OF OHIO. Jerry A. Snider & Barbara K. Andreas. Ohio Biological Survey Miscellaneous Contribution no. 2. Ohio State University, Columbus. 1996. iv + 105 pp. $15.00 (plus $1.50 shipping & handling in U.S. ($1.65 to Canada); Ohio residents add 5.75% sales tax) from Ohio Biological Survey, The Ohio State University, 1315 Kinnear Rd., Columbus, OH 43212-1192.

In spite of its history of glaciation, or perhaps because of it, the bryophyte flora of Ohio is quite rich and diversified, and with this completely specimen-based catalogue, it would appear to be more completely and certainly more accurately known than the flora of any other state of the union. It includes a checklist of 385 species and 15 varieties of mosses—nearly 30% of the moss flora of North America. Each species is mapped by county, and 30 additional maps seem to give hope for additions! The county maps show that more collections are desirable. It would be fun to collect there and to fill in dots, as an idiot's delight, of course, but also as a valuable contribution to phytogeography. The atlas should make it easy for beginners to know the expectable species, and for them the introduction gives useful information about methods of collection and specimen preparation. The authors are to be congratulated for providing a useful catalogue that mirrors their competence as bryologists.

——Howard Crum
University of Michigan

THE BIG TREES OF MICHIGAN
15. Populus deltoides Marsh.

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The largest known Eastern Cottonwood in Michigan is located in the city of Wayne in Wayne County of Michigan's Lower Peninsula.

Description of the Species: The Eastern Cottonwood is a member of the willow family, Salicaceae. In this family, the genus *Populus* is distinguished from the willows (*Salix* spp.) by their ovate to deltoid leaves and several overlapping bud scales (buds of *Salix* species are covered by only one scale). *Populus* species have coarsely toothed, lacerate, or fringed bracts in the inflorescence (bracts of *Salix* are smooth-edged) and a flower stigma of 4 or more lobes (*Salix* have flowers with 2 unlobed stigmas). Voss (1985) listed seven species of *Populus* in his *Michigan Flora.* The Eastern Cottonwood is distinguished from other poplars which grow in the state by having catkin scales which are deeply and conspicuously coarsely haired and having flowers with 3 or 4 stigmas. The leaves are broadly triangular with coarse teeth conspicuously incurved (Fig. 1).

Location of Michigan's Big Tree: Michigan's largest Eastern Cottonwood is located in floodplain woods along the Lower Branch of the Rouge River in Wayne, Michigan, a suburb of Detroit. In Wayne, a paved bike trail runs behind a small cemetery on the north side of Route 12 (Michigan Avenue). If one walks across the cemetery and west 205 meters (225 yards) on the bike trail, the tree can be found 11.5 meters (37′ 9″) off the south side of the bike trail. Its large size makes it very conspicuous. Surrounding vegetation is typical of a floodplain forest and includes American Elm, Box Elder, Sugar Maple, and Silver Maple.

Description of Michigan's Big Tree: The trunk of the tree splits into three trunks at about 3 meters (10′) above the ground. The middle trunk has been broken off some time ago, forming a small cavity accessible from above. The circumference of the tree at breast height was measured on October 25, 1992 at 343″ (870 cm) [Diameter = 109″ (277 cm)]. The circumferences of the two side trunks both measured approximately 156″ (396 cm). The crown spread was measured at 92′ (28 m), substantially less than the 160′ reported by Thompson

[1]Deceased 20 September 1994.

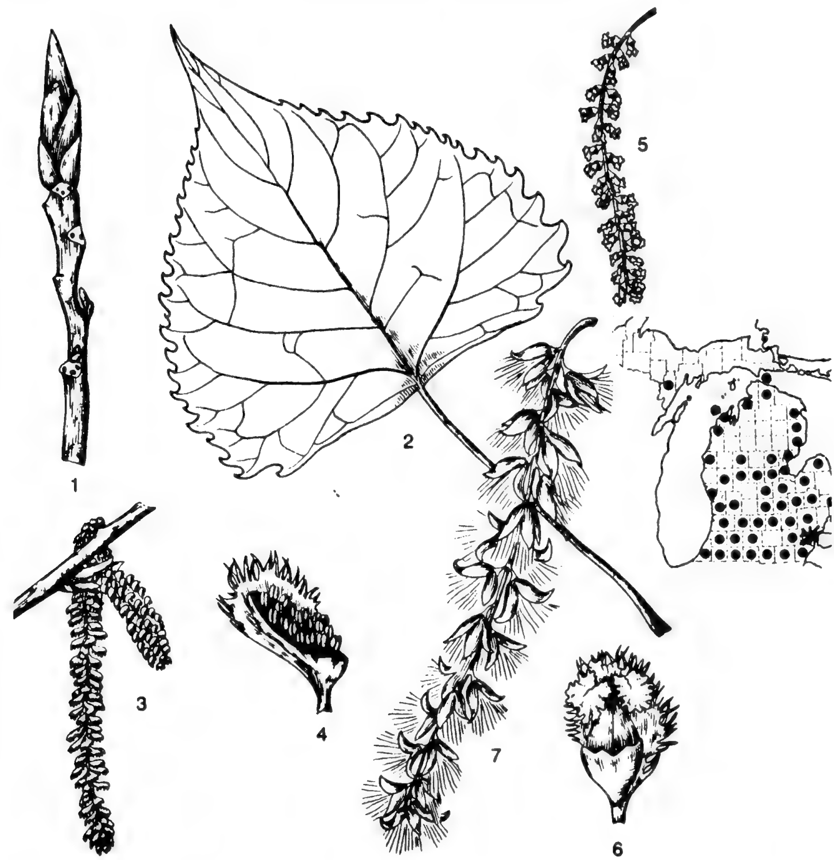

FIGURE 1. Documented distribution in Michigan and characteristics of the Eastern Cottonwood. Map is from Voss (1985). The star indicates the location of Michigan's Big Tree. Illustrations are from Barnes & Wagner (1991). 1. Winter twig, ×1; 2. Leaf, ×1/2; 3. Male flowering catkin, ×1/2; 4. Male flower, enlarged; 5. Female catkin, ×1/2; 6. Female flower, enlarged; 7. Fruiting catkin with open capsules, ×1/2.

(1986). The tree is 107' tall (33 m), much shorter than the 148' reported by Thompson (1986). Although crown size appears to have decreased, its state champion status remains secure because state champion trees are determined by the circumference of the trunk at breast height.

INVITATION TO PARTICIPATE

If you would like to join us in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B.

Ehrle for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property.

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EDITORIAL NOTICE
CALL FOR COVER PHOTOGRAPHS

The file from which I choose photographs for the cover of the *Botanist* is beginning to look a little thin, so I encourage all subscribers and readers of the journal to submit photographic prints for consideration. They should be sharp and with good contrast, black & white or color, in horizontal format, 3″ × 5″ or larger. The subject can be anything botanical, including significant or interesting sites or events. There can be people in the picture if appropriate. Photos must be accompanied by identification of the subject (including date and name of photographer, if known). They should be sent to: Editor, The Michigan Botanist, Herbarium, North University Bldg., University of Michigan, Ann Arbor, MI 48109-1048.

I know that there are lots of great photographers out there. This is your big chance to be published in (or on) the *Michigan Botanist.* Send in your photos today!

MICHIGAN PLANTS IN PRINT
NEW LITERATURE RELATING TO MICHIGAN BOTANY

Continued from this journal 32: 230 (1993). After regrettable diversions by this compiler to accomplish other tasks*, this section resumes with its original aim of listing new literature (anything from 1960 onwards) relating to Michigan botany under four categories: A. Maps, Soils, Geology, Climate, General (new maps and selected bulletins or articles on matters useful to field naturalists and students of plant distribution in the state); B. Books, Bulletins, etc., and C. Journal Articles (listing, respectively, all separate publications and all articles (in other journals) which cite Michigan specimens or include research based on plants of wild origin in Michigan—not generally including work on cultivated plants nor strictly economic aspects of forestry, conservation, or agriculture); D. History, Biography, Exploration (institutions as well as travels and lives of persons with Michigan botanical connections). When the subject matter or relation to Michigan is not clear from the title, annotations are added in brackets.

Scanning of some journals is more up-to-date than for others. Readers are urged to call attention to titles that have been missed (or to submit reprints)—that will speed up their listing.

— Edward G. Voss

A. MAPS, SOILS, GEOLOGY, CLIMATE, GENERAL

Campbell, Jonathan. 1990. The Woodtick Peninsula: A rare and threatened landform. Michigan Academ. 22: 125–141. [Nature and history of this Monroe County site, with maps, plus alternatives for its restoration (to protect Erie Marsh and I-75).]

Holzman, Richard W., Bertha A. Daubendiek, Lyle Rizor, & Forbes Sibley (eds.). 1994. Michigan Nature Association Nature Sanctuary Guidebook. Michigan Nature Association, Box 102, Avoca, Michigan 48006. 128 pp. $29.00. [See review in this journal 33: 94 (1994).]

MacFarlane, Ruth B. (Alford). 1994. Collecting and Preserving Plants. New York, Dover. 184 pp. $5.95 + $3.00 postage/handling per order. [A Dover reprint of useful book published in 1985 and reviewed in this journal 26: 160 (1987); many examples (illustrations, labels, suggested literature), not to mention the author, are from Michigan, but not really a "Michigan" book. Said to be "corrected" but any corrections are minimal, so previous errors continue and some statements are dated, e.g. prediction that Case's orchid book is "soon to be reissued," when in fact a new edition appeared in 1987.]

Rauhe, Warren J. 1993. John Henes Park, Menominee, Michigan: Renovation of an historic landscape. Michigan Academ. 25: 431–442. [History of 43-acre park designed by O. C. Simonds and "predominantly wooded," adjacent to the Wisconsin state line and the site of numerous collections. Includes map and photos. New master plan leaves most of the park in its natural state.]

(U. S. Department of Agriculture, Natural Resources Conservation Service). Soil Surveys for Mason, Newaygo, Oceana, and Saginaw counties have been published since our previous listing (in May 1993). These all include complete aerial photographic coverage with boundaries of soil types overprinted, and are very useful in planning or interpreting field work. Michigan surveys are available from the Michigan Agricultural Experiment Station in East Lansing or the Natural Resources Conservation Service [formerly Soil Conservation Service], Room 101, 1405 S. Harrison Rd., East Lansing 48823.

(U. S. Geological Survey). The USGS now considers Michigan to be completely covered by 7.5-minute quadrangle topographic maps. Sale of all 15-minute maps has been discontinued. Maps are now $4.00 each, plus $3.50 per order for handling. For information or ordering assistance, call 1-800-USA-MAPS; mail orders to USGS Information Services, Box 25286, Denver, Colorado 80225.

*For a review of the product of some of those "other tasks", see p. 41 of this issue. —Editor

B. BOOKS, BULLETINS, SEPARATE PUBLICATIONS

Crum, Howard. 1991. Liverworts and Hornworts of Southern Michigan. Univ. Michigan Herbarium, Ann Arbor. 233 pp. $18.00. [Supersedes Steere's "Liverworts of Southern Michigan" (1940, reprinted 1950) with an up-to-date and more comprehensive treatment of 72 species in the southern part of the Lower Peninsula (42 counties, north to Muskegon, Newaygo, Mecosta, Isabella, Midland, Bay, and Huron, i.e., south of the "Tension Zone.") Although there are no maps, documented and reported counties are stated. Handsomely illustrated with both detail and habit sketches or photos, and embellished with small bits of history, folklore, and pithy applicable literary quotations (as one expects fron the author). See review in this journal 30: 134–135 (1991).]

Glime, Janice M. 1993. The Elfin World of Mosses and Liverworts of Michigan's Upper Peninsula and Isle Royale. Isle Royale Natural History Assoc., Houghton. 148 pp. $15.95. [A field guide to 123 species, beautifully illustrated with color photos and intended for non-professionals. Includes phonetic pronunciations for scientific names (although *recurvirostre* comes out ree cur vih rah' struhm); as the author notes in urging use of these names: "then, as stated by my Japanese friend who knew very little English, 'you can talk to anyone in the world.'" For detailed reviews, see Ehrle in this journal, 33: 115–116 (1994) and Vitt in Bryologist 97: 472–473 (1994). For information on ordering, call 1-800-678-6925.]

Goff, F. Glenn, & John J. Rochow. 1993. Michigan Trees: A Picture Key. Michigan Society of Registered Land Surveyors, 220 South Museum Dr., Lansing, Michigan 48933. 24 pp. $1.50. [Revision of a 1967 version. Includes no key, but has good drawings of leaves or branchlets, descriptive notes, wetland indicator values, and distribution maps (from *Michigan Flora*).]

Leatherberry, Earl C. 1994. Forest Statistics for Michigan's Northern Lower Peninsula, 1993. U. S. Dep. Agr. For. Serv. Resource Bull. NC-157. 48 pp. [One of a series (see next three titles) presenting a great deal of data on Michigan's forests, and comparisons with the previous (1980) inventory by the Forest Service. The 33 counties in this unit are reported to contain 7,415.2 thousand forested acres. It is a bit shocking to see listed under "Tree Species Groups in Michigan's Northern Lower Peninsula" such names as Engelmann spruce, river birch, and persimmon, none of which grow anywhere in Michigan (except perhaps in cultivation). Furthermore, study of the "Definition of Terms" is revealing, e.g., "Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide." As the Upper Peninsula Environmental Coalition has pointed out: ". . . the forest inventory contains every plot of trees in the state that is at least 1 acre in size and that has trees on at least 16% of the area. It also assumes that every tree is available for timber harvest unless it has been officially set aside by Congress or the State (as in wilderness areas or state parks). . . Other land is not available simply because many land owners don't hold their land for timber harvesting purposes, but for other reasons (fully 46% of Michigan's timberlands are owned by non-industrial private landowners). Using the forest inventory to predict timber availability is therefore absurd. . . . What we need are careful timber availability studies that show how much wood is actually available for harvest."]

Leatherberry, Earl C. 1994. Forest Statistics for Michigan's Western Upper Peninsula Unit, 1993. U. S. Dep. Agr. For. Serv. Resource Bull. NC-153. 45 pp. [This unit of 8 counties is reported to contain 4,836.5 million [sic] forested acres; see comments above.]

Schmidt, Thomas L. 1993. Forest Statistics for Michigan's Eastern Upper Peninsula Unit, 1993. U. S. Dep. Agr. For. Serv. Resource Bull. NC-150. 46 pp. [This unit of 7 counties is said to contain 3,973.1 thousand forested acres; see comments above. Among the "Tree Species Groups in Michigan's Eastern Upper Peninsula" are Engelmann spruce, river birch, winged elm, Ohio buckeye, sweet birch, and northern catalpa (apparently as commercial species, for others are listed as "noncommercial species"); these are ridiculous!]

Schmidt, Thomas L. 1994. Forest Statistics for Michigan's Southern Lower Peninsula Unit, 1993. U. S. Dep. Agr. For. Serv. Resource Bull. NC-155. 46 pp. [This unit of 35 counties is reported to contain 3,053.7 thousand forested acres; see comments above.]

Schmidt, Thomas, & Mike Lanasa. 1995. The Forest Resources of the Hiawatha National Forest, 1993. U. S. Dep. Agr. For. Serv. Resource Bull. NC-163. 35 pp. [A great deal of data on forest composition.]

Slavick, Allison D., & Robert A. Janke. 1993. The Vascular Flora of Isle Royale National Park. 3rd ed. Isle Royale Natural History Assoc., Houghton. 50 pp. $3.95. [Replaces the 2nd ed., which

was published in this journal, May 1987, and differs but little, including adjustment of nomenclature to conform to the 2nd ed. of Gleason and Cronquist's *Manual* and a few revisions of identification. For information on ordering, call 1-800-678-6925.]

Smith, Norman F. 1995. Trees of Michigan and the Upper Great Lakes. 6th ed. Thunder Bay Press, 720 E. Shiawassee, Lansing 48912. 178 pp. $21.95. [The previous edition of this excellent and long-familiar work was reviewed in this journal 18: 24 (1979); and this new one, 34: 102–103 (1995). The current edition is illustrated with over 300 color photos, but a few species are still omitted and the text repeats minor problems, e.g., Ohio buckeye is mentioned only under horsechestnut and is said to be "occasionally found in the southwestern part of Michigan"—true but misleading, for it is more widespread in the southeastern part (as mapped in *Michigan Flora* Part II). For ordering information call 1-800-336-3137.]

Swink, Floyd, & Gerould Wilhelm. 1994. Plants of the Chicago Region. ed. 4. Indiana Acad. Sci., Indianapolis. xiv + 921 pp. $35.00. [This extraordinarily fine flora includes Berrien as the only Michigan county among the 22 covered. See review in this journal 34: 103–104 (1995).]

C. JOURNAL ARTICLES

Alexeev, E. B. 1982. New and little-known fescues (Festuca L.) of North America. Bull. Mosk. Obshch. Isp. Pri. Biol. 82(1): 109–118. [Text in Russian except for Latin descriptions. *F. michiganica* sp. nov. is included, with type "Midland County, sandy ground, back of Protestant Cemetery," *Dreisbach 4856*, June 8, 1929. N.B.: duplicates of this number were widely distributed by Dreisbach as *F. ovina*, according to his exchange records in Univ. Mich. herbarium.]

Batterson, Ted R., Clarence D. McNabb, & Frederick C. Payne. 1991. Influence of water level changes on distribution of primary producers in emergent wetlands of Saginaw Bay. Michigan Academ. 23: 149–159. [Study on Defoe Reef concludes that "changes in water level, both long term (years) and short term (hours or days) affect wetlands of Saginaw Bay."

Beitel, Joseph M., & John T. Mickel. 1992. The Appalachian firmoss, a new species in the Huperzia selago (Lycopodiaceae) complex in eastern North America, with a new combination for the western firmoss. Am. Fern J. 82: 41–46. [*H. appalachiana* (new sp.) cited from Isle Royale (Passage Island and Scoville Pt.).]

Browning, J., K. D. Gordon-Gray, & S. G. Smith. 1995. Achene structure and taxonomy of North American Bolboschoenus (Cyperaceae). Brittonia 47: 433–445. [Although one specimen of *B. fluviatilis* is cited from Michigan, "Sandusky Co.," there is no such county in the state and the full location cited, as well as the label on the specimen itself, clearly indicate Ohio.]

Brunton, Daniel F., & W. Carl Taylor. 1990. Isoëtes ×brittonii hybr. nov. (Isoëtaceae): A naturally occurring hybrid (I. engelmannii × I. riparia) in the eastern United States. Am. Fern J. 80: 82–89. [Map shows *I. engelmannii* in southwestern Lower Peninsula.]

Case, Martha A. 1993. High levels of allozyme variation within Cypripedium calceolus (Orchidaceae) and low levels of divergence among its varieties. Syst. Bot. 18: 663–677. [Half the populations studied were in Michigan (localities cited and mapped). Concludes that the varieties "are considered members of a single species."]

Chmielewski, J. G., & C. C. Chinnapa. 1988. The genus Antennaria (Asteraceae: Inuleae) in North America: multivariate analysis of variation patterns in Antennaria rosea sensu lato. Canad. J. Bot. 66: 1583–1609. [Michigan record for Isle Royale included on overall distribution map but not on map for any of the component microspecies.]

Dorn, Robert D. 1995. A taxonomic study of Salix section Cordatae subsection Luteae (Salicaceae). Brittonia 47: 160–174. [A few Michigan specimens included among citations for *S. eriocephala* var. *eriocephala, S. cordata*, and *S. myricoides* var. *myricoides* and var. *albovestita*; some others are mapped.]

Farrar, Donald R., & Cindy L. Johnson-Groh. 1991. A new prairie moonwort (Botrychium subgenus Botrychium) from northwestern Minnesota. Am. Fern J. 81: 1–6. [Illustrations include *B. spathulatum* from Alger Co. and *B. minganense* from Emmet Co.]

Freudenstein, John V., & Jeff J. Doyle. 1994. Plastid DNA, morphological variation, and the phylogenetic species concept: The Corallorhiza maculata (Orchidaceae) complex. Syst. Bot. 19: 273–290. [Michigan material from 10 counties was among the samples analyzed.]

Hull, Christopher N. 1986. The birds of the Holly State Recreation Area, Oakland County, Michi-

gan. Michigan Acad. 18: 221–245. [Site descriptions include map and vegetation notes on 8 areas.]

Kapp, Ronald O., & Gerald D. Winn. 1987. An ecological survey of the Ore-Ida Prairie Preserve, Newaygo County, Michigan. Michigan Academ. 19: 209–216. [Vegetation survey of Nature Conservancy preserve, now named as a memorial honoring the late senior author of this paper.]

Les, Donald H., James A. Reinartz, & Elizabeth J. Esselman. 1991. Genetic consequences of rarity in Aster furcatus (Asteraceae), a threatened, self-incompatible plant. Evolution 45: 1641–1650. [Distribution map shows three locations in Michigan (no county borders), based on specimens examined by W. Lamboy.]

Liggett, Christopher, & Larry A. Leefers. 1990. Temporal aspects of ecosystem biodiversity: A case study of the aspen types in Michigan. Michigan Academ. 22: 371–379. [Historical and projected change in commercial forest acreage.]

Luken, James O., John W. Thieret, & John R. [sic = T.] Kartesz. 1993. Erucastrum gallicum (Brassicaceae): Invasion and spread in North America. Sida 14: 569–582. [Includes mention of first report from Michigan, which is covered in distribution maps.]

Luken, James O., & John W. Thieret. 1995. Amur honeysuckle (Lonicera maackii; Caprifoliaceae): Its ascent, decline, and fall. Sida 16: 479–503. [Areas where the species is considered a problem weed include the Beal Botanic Gardens and the Matthaei Botanical Garden.]

Lutzoni, François M. 1994. Ionaspis alba (Ascomycotina, Hymenellaceae), a new lichen species from eastern North America. Bryologist 87: 393–395. [The only Michigan collection cited is from Mecosta Co., in the west-central Lower Peninsula; but the map of "known distribution" has two dots in the eastern Upper Peninsula and none in the Lower Peninsula, leaving some doubt as to where this species of the Appalachian and Great Lakes region really occurs in the state.]

McNabb, Clarence D., & Ted R. Batterson. 1991. Occurrence of the common reed, Phragmites australis, along roadsides in lower Michigan. Michigan Academ. 23: 211–220. [One is reminded of Roland Harper's classic "Car Window Notes" by this account of *Phragmites* observed along 5380 km of major highways in the Lower Peninsula. Densest populations were between Port Huron and Toledo; no plants were observed in north-central Lower Peninsula. No effort was made to discriminate between aggressive Old World variants and native plants or to determine whether there is in fact any production or dissemination of seeds (which Canadian botanists report not to be formed in Ontario).]

Milanowski, Dennis J., & Catherine E. Bach. 1994. Between-site variation in suitability of Salix cordata as a host for Altica subplicata (Coleoptera: Chrysomelidae). Great Lakes Entomol. 26: 253–261. [Includes observations, with SEM views, on differing densities of leaf trichomes at Pte. aux Chênes and Grass Bay.]

Miyawaki, Hiromi. 1994. Lecanora imshaugii, a lichen of eastern North America and Eastern Asia. Bryologist 97: 409–411. [No localities cited except for the type (Canada), but small map has one dot covering north half of Lower Peninsula.]

Mortensen, Richard D. 1989. The development of isolated cells of the fern Onoclea sensibilis L., following exposure to the enzyme cellulase. Michigan Academ. 21: 67–74. [Origin of the experimental material was near Albion.]

Poelt, Josef, & Thomas H. Nash III. 1993. Studies in the Umbilicaria vellea group (Umbilicariaceae) in North America. Bryologist 96: 422–430. [New species of this lichen, *U. americana*, cited from Keweenaw Co. (map indicates Isle Royale).]

Pryer, Kathleen. 1992. The status of Gymnocarpium heterosporum and G. robertianum in Pennsylvania. Am. Fern J. 82: 34–39. [Distribution map has dots in Michigan for *G. robertianum*.]

Ramp, Paul F., & Stephen N. Stephenson. 1988. Gender dimorphism in growth and mass partitioning by box-elder (Acer negundo L.). Am. Midl. Nat. 119: 420–430. [Study in Lansing area.]

Raphael, C. Nicholas. 1987. Prehistoric and historic wetland heritage of the upper Great Lakes. Michigan Academ. 19: 331–365. [Deals primarily with "aboriginal utilization," including a table modified from Yarnell (the modification including many major misspellings), with some material on 19th century native uses. Lacks botanical evaluation of accuracy of identification and of determination of indigenous or introduced status.]

Roloff, Gary J., Jonathan B. Haufler, & Michael C. Reynolds. 1994. Variability in the structure and composition of regenerating aspen with implications for ruffed grouse management. Michigan Academ. 26: 75–82. [Brief characterizations of *Populus tremuloides* stands in Alcona Co.]

Scheiner, Samuel M. 1988. Population dynamics of an herbaceous perennial Danthonia spicata dur-

ing secondary forest succession. Am. Midl. Nat. 119: 268–281. [Studies on burned sites at the University of Michigan Biological Station.]

Scheiner, Samuel M., & Conrad A. Istock. 1994. Species enrichment in a transitional landscape, northern lower Michigan. Canad. J. Bot. 72: 217–226. [Study of 47 sites from Hartwick Pines northward led to conclusions that species richness was greatest in sites with the greatest percentage of northern species and that the region is more species-rich than adjacent regions to the south or north.]

Schloesser, Donald W., & Bruce A. Manny. 1989. Potential effects of shipping on submersed macrophytes in the St. Clair and Detroit rivers of the Great Lakes. Michigan Academ. 21: 101–108. [Despite "potential" in the title, does in fact interpret lower frequencies of aquatic plants in shipping channels (compared to non-shipping channels) to effects of prior vessel passages.]

Stephenson, Stephen N. 1986. A comparison of life history characteristics of selected dioecious plants in Michigan. Michigan Academ. 18: 159–174. [Allocation of production, phenology, and population structure for selected annual, perennial, and woody species.]

Taylor, Sylvia M. 1990. The Alleghany plum of Michigan's jack pine plains. Michigan Academ. 22: 381–384. [Distribution (with map) and habitat.]

Taylor, Sylvia, & Barbara Jones. 1995. Propogation [sic] of Alleghany plum seedlings for wildlife plantings. Michigan Academ. 27: 163–168. [Observations in field, greenhouse, and nursery based on material from jack pine plains of Oscoda Co.]

Turner, Billie L. 1995. Synopsis of the genus Onosmodium (Boraginaceae). Phytologia 78: 39–60. [Maps *O. bejariense* var. *hispidissimum* from Berrien Co., presumably based on the only Michigan collection known to this compiler, made by the First Survey in 1838 and in the Gray Herbarium of Harvard University.]

Wagner, W. H., Jr., & F. S. Wagner. 1990. Notes on the fan-leaflet group of moonworts in North America with descriptions of two new members. Am. Fern J. 80: 73–81. [*Botrychium pallidum* cited from Chippewa and Wayne counties and S. Manitou Island., mentioned in text from Crawford Co., and mapped from all four areas; *B. spathulatum* (also new) cited and mapped from Alcona, Alger, Leelanau, and Mackinac county mainland plus Drummond and S. Manitou islands, and all fronds illustrated are also from Michigan.]

Werner, Patricia A. 1977. Colonization success of a "biennial" plant species: Experimental field studies of species cohabitation and replacement. Ecology 58: 840–849. [Seeds of *Dipsacus sylvestris* from Lenawee Co. and young rosettes transplanted from East Lansing were experimentally introduced into plots at the Kellogg Biological Station.]

Werner, Patricia A., & Hal Caswell. 1977. Population growth rates and age versus stage-distribution models for teasel (Dipsacus sylvestris Huds.). Ecology 58: 1103–1111. [Studies in Kalamazoo Co. fields.]

Winters, Harold A., & Richard L. Rieck. 1991. Late glacial terrain transformation in Michigan. Michigan Academ. 23: 137–148. [C-14 dates averaged ca. 35,000 B.P. from organic material overlain by glacial deposits in Kalkaska Co. Wood of spruce or larch and pollen suggest boreal forest at the time.]

Zimmerman, Craig A. 1976. Growth characteristics of weediness in Portulaca oleracea. Ecology 57: 964–974. [Seed source was near Ann Arbor.]

Zimmerman, Craig A. 1977. A comparison of breeding systems and seed physiologies in three species of Portulaca. Ecology 58: 860–868. [Seed source of *P. oleracea* was from Ann Arbor area.]

D. HISTORY, BIOGRAPHY, EXPLORATION

(Anon.) 1994. Dr. Cyrus Longworth Lundell, Am. Soc. Pl. Taxon. Newsl. 8(3): 10–12. [Biographical sketch of Lundell, who died March 28, 1994, in Texas, and was at the University of Michigan 1932–1944, first as a graduate student and ultimately as curator of phanerogams in the Herbarium. He made numerous collections in Michigan during those years, but is better known for his work in the Southwest and Central America.]

Caruso, Virginia Paganelli, & Laurel A. Grotzinger. 1994. "To forward the study": The centennial history of the Michigan Academy of Science, Arts, and Letters. Michigan Academ. 26: 547–598.

[Several botanists are mentioned, especially among the founders and early members of the Academy. This article is followed by author and title indices to the Michigan Academician vols. 1–26.]

Bigelow, Howard E. 1987. Alexander H. Smith. Taxon 36: 700–702. [Sketch of the life and accomplishments of the Michigan-based mycologist—prolific collector, author, and lecturer.]

Howard, Richard A. 1994. The role of botanists during World War II in the Pacific Theatre. Bot. Rev. 60: 197–257. [The role surveyed obviously does not involve Michigan, but a dozen of the persons mentioned were at one time or another situated in Michigan and this account supplements better-known aspects of their lives.]

Paterson, Robert A, 1978. Frederick Kroeber Sparrow (1903–1977). Mycologia 70: 213–221. [A fine biographical sketch (which somehow eluded more timely listing here) of the distinguished aquatic mycologist, University of Michigan professor and former director of its Biological Station, who collected both vascular and non-vascular plants in the state.]

Pringle, James S. 1989. Botanical exploration of the Canadian watershed of Lake Huron during the nineteenth century. Canad. Hort. Hist. 2(1 & 2): 4–88. [Explicitly supplementing the lamentably brief coverage of the region in Voss' "Botanical Beachcombers and Explorers" (1978), this is a thorough, superbly indexed and documented, well written account that includes some data on collectors also known for their Michigan activities, such as E. P. Austin, Robert and John Bell, and C. K. Dodge.]

Rossi-Wilcox, Susan M. 1993. Henry Hurd Rusby: A biographical sketch and selectively annotated bibliography. Harvard Pap. Bot. 4: 1–30. [Refers to Rusby's 1884–1887 employment (as plant explorer and herbarium curator) by Parke-Davis and Co.; during this period he also collected some plants in Michigan (not mentioned).]

Schlereth, Thomas J. 1993. A place, its plantsmen, and its plants. pp. 25–45 in Barbara J. Hellenthal, Thomas J. Schlereth, & Robert P. McIntosh, Trees, Shrubs, and Vines on the University of Notre Dame Campus. Univ. Notre Dame Press. 286 pp. [This historical chapter has much information on Father Peter E. Hebert, Michigan native and diligent collector, especially in Berrien and Huron counties, professor of Greek and Latin at Notre Dame, but perhaps better known as a botanist (at times collaborator with F. J. Hermann). Others mentioned who collected in Michigan include, of course, J. A. Nieuwland and E. L. Greene, as well as Sister M. Marcelline Horton, of Grand Rapids, who met Father Hebert during summer studies at Notre Dame and introduced him to botany.]

Stuckey, Ronald L. 1993. Ann (Waterman) Rudolph (1934–1991). Ohio Jour. Sci. 93: 163. [A native of Leelanau County, Ann Waterman collected especially in that part of the state and received her B. S. and M. S. degrees from Michigan State University, the latter with a thesis on the mints of Michigan. See also this journal, 34: 24–45 (1995).]

Tiehm, Arnold, & Frans A. Stafleu. 1990. Per Axel Rydberg: Biography, Bibliography, and List of His Taxa. Mem. New York Bot. Gard. 58. 75 pp. $19.00. [Those familiar with Rydberg's later floras and monographs may be unaware that when he emigrated from Sweden in 1882 he worked in the iron mines of the Upper Peninsula, where he met with a serious accident in 1884. He then taught at Luther Academy in Nebraska, but made a collecting trip to the Upper Peninsula in 1889. In 1898 he received his Ph. D. from Columbia and for the rest of his professional life he was associated with the New York Botanical Garden.]

Wagner, Warren H., Jr. 1990. Biological diversity: Underlying concepts. Michigan Academ. 22: 311–317. [Brief historical sketch of biodiversity activities with reference to Michigan individuals and organizations, as introduction to a symposium (on biological diversity in Michigan forests), which mostly deals in a broad way with public and corporate land policies; but see also Liggett & Leefers paper in sec. C above.]

REVIEWS

THE DICOTYLEDONEAE OF OHIO Part 2. Linaceae through Campanulaceae. Tom S. Cooperrider. Ohio State University Press, Columbus. 1995. 656 pp. $65.00 (plus $3.50 shipping & handling, $3.73 Ohio sales tax if mailed within Ohio, or 7% GST if mailed to Canada).

This volume is further identified as "The Vascular Flora of Ohio Volume Two." Volume One was the excellent work of E. Lucy Braun on the Monocotyledoneae, published in 1967. The previous "Volume 2" was a modest (over-priced) one dealing solely with the Asteraceae (Dicotyledoneae Part 3), published in 1989 (but dated 1988). We wait with bated (but not held) breath for the rest of Volume Two, i.e., Part 1 of the Dicotyledoneae (Saururaceae through Fabaceae), being written by John Furlow and which will complete this vascular flora of Ohio [if one includes *The Woody Plants of Ohio* by E. Lucy Braun, published in 1961 without volume number and apparently the only volume to include the gymnosperms, the other woody plants being covered again in the monocot and dicot volumes].

Bibliographic complexity aside (a second "volume" consisting of three parts, published in reverse order), this is a truly outstanding flora. The Ohio Flora Project was launched in 1950, the year that Tom Cooperrider graduated from college and began graduate work at the University of Iowa. Now, he has just retired as chairman of that committee of the Ohio Academy of Science, one of the sponsors of the Ohio Flora. The Division of Natural Areas and Preserves of the Ohio Department of Natural Resources has also aided the project. The present volume includes over 700 species in 77 families and is complete with identification keys, Ohio distribution maps (by county), and excellent illustrations. There are many helpful comments on identification, uses of plants, and relevant literature.

At nearly 5 pounds, this hefty tome with its large pages, wide margins, and glossy paper is a bit much to carry into the field, but plant lovers in areas neighboring Ohio will find it a very useful reference and a welcome alternative to any local flora they may possess.

OF WOODS AND OTHER THINGS. Emma Bickham Pitcher. Beech Leaf Press, Kalamazoo. 1996. 255 pp. $10.95 (plus $3.50 shipping & 6% Michigan sales tax within the state, from Kalamazoo Nature Center, 7000 North Westnedge Ave., Kalamazoo, Michigan 49004).

This collection of over 60 observant essays represents about half of the author's weekly nature columns contributed by the Kalamazoo Nature Center to the Kalamazoo *Gazette* over the previous decade. They have been edited and placed in a logical sequence under general categories such as "Of Feathers," "Of Petals," "Of Trees," and "Of Scenes and Seasons." This is a delightful little book to have handy for bedside reading or in one's pocket for use while waiting in the airport or other place where a refreshing portrait of outdoor things can help one's composure. Michigan is fortunate that so talented and cheerful a writer, formerly at the Indiana Dunes and an administrator at the University of Chicago, chose to settle (if that is an appropriate word for so wide a traveler!) in her retirement here in Michigan and participate so actively in the Michigan Botanical Club, Kalamazoo Nature Center, and other worthy organizations.

Most readers will not see the apt connection in printing this review after the previous one. However, Bickie Pitcher was a "faculty wife" when Tom Cooperrider and this reviewer were both undergraduates at Denison University and it is pleasant to have this little reunion in print after 50 years!

—Edward G. Voss
University of Michigan Herbarium

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On the cover: *Chokeberry* (Aronia prunifolia) *at Hoop Lake. Photographed by Sandra L. Planisek.*

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THE MICHIGAN BOTANIST

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THE MICHIGAN BOTANICAL CLUB

Membership in the Michigan Botanical Club is open to anyone interested in its aims: conservation of all native plants; education of the public to appreciate and preserve plant life; sponsorship of research and publication on the plant life of the State; sponsorship of legislation to promote the preservation of Michigan native flora; establishment suitable sanctuaries and natural areas; and cooperation in programs concerned with the wise use and conservation of all natural resources and scenic features.

Dues are modest, but vary slightly among the chapters and with different classes of membership. Persons desiring to become state members (not affiliated with a local chapter, for which contact persons are listed below), may send $17.00 dues to the Membership Chairperson listed below. In all cases, dues include a subscription to *THE MICHIGAN BOTANIST*. (Institutions desiring to subscribe should deal directly with the Business and Circulation Manager.) Foreign subscribers should remit in U.S. funds.

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HABITAT DIFFERENCES AMONG SEVEN SPECIES OF *MYRIOPHYLLUM* (HALORAGACEAE) IN WISCONSIN AND MICHIGAN

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ABSTRACT

Thirty-five *Myriophyllum* (milfoil) habitats in Wisconsin and the Upper Peninsula of Michigan were evaluated to determine differences in habitat characteristics between two groups of species. Habitats of three "northern" species (*M. alterniflorum*, *M. farwellii*, and *M. tenellum*) differed significantly from the habitats of four "widespread" species (*M. heterophyllum*, *M. sibiricum*, *M. spicatum*, and *M. verticillatum*) for five of nine water and sediment variables analyzed. Habitats of the northern milfoil species were poor in silt and clay, and were characterized by acid to neutral pH and low levels of calcium and sediment ammonium nitrogen. Habitats of the widespread species had higher proportions of silt and clay, neutral to alkaline pH, and high concentrations of both calcium and sediment ammonium nitrogen. These results support the generalization that northern milfoil species are associated with soft water oligotrophic habitats, whereas widespread milfoil species occur in hard water eutrophic habitats.

INTRODUCTION

The specific influence of the habitat on the distribution of aquatic vascular plants has long been a topic of contention. In his treatise on the classification of aquatic plant communities, Pearsall (1918) stated that ". . . just as there are terrestrial plant communities of organic and inorganic soils, there are also aquatic communities of these habitat types." He later concluded that submerged aquatic plant distributions depended more on sediment variables than on lake water chemistry or physical conditions of the habitat (Pearsall 1921). Conversely, Spence (1964) and Seddon (1972) argued that water chemistry rather than sediments was the determining factor that governed aquatic plant distribution. Although he considered that water chemistry may be an important determinant of aquatic plant distributions, Moyle (1945) suggested that sediments and the

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physical nature of the water also greatly influenced local species distributions. Because the mineral composition of natural waters is directly influenced by the type and composition of the underlying sediments and watershed (Rodhe 1949, Stumm & Morgan 1981), it is evident that both substrate and water composition ultimately determine the types of aquatic plant communities present and thus the particular species found within them.

In North America, aquatic plant species have been categorized as "northern," "southern," "widespread," etc. depending on their present distribution pattern (Stuckey 1971). Although these designations might imply differential climatic tolerances, the different distribution patterns cannot be adequately explained on the basis of latitudinal climatic gradients alone. Climatic conditions seem to be less influential on the distributions of submersed aquatic plants, owing in part to their wide temperature tolerances (Les 1986). Stuckey (1983, 1993), however, suggested that the absence of certain aquatic plant species from the "prairie peninsula" was perhaps due to warming climatic conditions of the xerothermic period. Although one might expect these "missing" species to be mainly those with northern distributions (which presumably would be less adapted to warmer temperatures), this was not the case. Stuckey (1983, 1993) observed that plants absent from the prairie peninsula included species distributed mostly north of, mostly south of, and equally north and south of the prairie peninsula. Most of the aquatic species absent from the prairie peninsula were typically plants of acidic soft water habitats (Stuckey 1993).

Water hardness and pH have long been implicated as major determinants of freshwater plant and animal distributions (Edmondson 1944, Wetzel 1983). Different levels of tolerance to water hardness and pH have been suggested by submersed aquatic plant "associations" (Spence 1964). Interspecific differences in tolerance to water hardness have also been shown for congeneric species of *Eleocharis* (Moyle 1945), *Potamogeton* (Lohammar 1938), *Sagittaria*, *Scirpus* (Curtis 1971), and *Myriophyllum* (Hutchinson 1970).

Lake habitats are categorized as "soft" or "hard" water depending on whether their water is derived from the drainage of acidic or calcareous deposits (Wetzel 1983). Calcareous hardwater lakes are buffered strongly at pH values above 8, whereas soft water lakes are more poorly buffered with pH values less than 7 (Wetzel 1983). In the upper Great Lakes region, there is a general north-south geographic orientation to lake hardness. Acidic-soft lake waters overlie granitic and igneous bedrock in northern Wisconsin and the western Upper Peninsula of Michigan, whereas alkaline-hard lake waters predominate over limestone bedrock in the southern portions of these states (Curtis 1971, Dorr & Eschman 1970, Martin 1965, Wilson 1939). Therefore, the distributions of many "northern" or "widespread" aquatic plant species in the Great Lakes region may result from their specific tolerance to water hardness rather than their adaptation to particular climatic factors.

Because aquatic plants often display different chemical tolerances (Moyle 1945), various authors have considered the importance of aquatic macrophyte communities as indicators of environmental conditions (e.g. Curtis 1971, Seddon 1972, Stuckey 1971, 1975, Swindale & Curtis 1957). Stuckey (1971, 1975) associated habitat conditions and the geographic distributions of freshwater

macrophytes, concluding that species with northern distributions generally occupy oligotrophic habitats, whereas those that are widespread geographically exist under more eutrophic conditions.

We are interested in investigating the nature of morphological and physiological adaptations in the water milfoil genus *Myriophyllum* (Haloragaceae). Interspecific differences in submerged leaf shape in *Myriophyllum* have been associated with geographical distribution and habitat differences (Gerber & Les, 1994); however, the habitats of milfoil species have not been quantified adequately. The purpose of this study was to analyze quantitative habitat data and to assess the association of habitat variables with the distributional patterns of seven *Myriophyllum* species found in the upper Great Lakes region. This comparison provides us with critical base-line information to facilitate our study of habitat-linked adaptations in the genus.

MATERIALS AND METHODS

We separated seven *Myriophyllum* species into two groups based on their present geographical distributions and published habitat descriptions (Aiken 1981, Beal 1977, Ceska & Warrington 1976, Correll & Correll 1972, Crow & Hellquist 1983, Fassett 1930a, 1930b, Hutchinson 1975, Muenscher 1944, Reed 1977, Voss 1985): 1) a "northern" group including *Myriophyllum alterniflorum* DC, *M. farwellii* Morong, and *M. tenellum* Bigelow; and 2) a "widespread" group including *M. heterophyllum* Michaux, *M. sibiricum* Komarov, *M. spicatum* L., and *M. verticillatum* L.

We selected 35 different sites (5 sites/species) in Wisconsin and the Upper Peninsula of Michigan for study of habitat variables (Fig. 1). Voucher specimens were collected from each site and are deposited in the University of Wisconsin-Milwaukee herbarium (UWM).

Water and sediment samples were collected within or adjacent to *Myriophyllum* plant beds, from each site during August/September 1993. In the field, water samples were collected at a depth of 0.25 m, filtered (0.45µm), and stored on ice for later analyses. Light measurements were taken at all sites at depths of 0, 0.5, 1, and 1.5 m, when possible, to calculate extinction coefficents. Generally speaking, extinction coefficient values $< 1\ m^{-1}$ indicate clear water and those $> 6\ m^{-1}$ indicate turbid water (Wetzel 1983). In the lab, water pH and conductivity measurements were made at 24°C using an Orion Research digital ionalyzer/501. Water ammonium-nitrogen analysis followed a modified Koroleff (1983) method. Water calcium levels were determined by atomic absorption on an Instrumental Laboratory aa/ae spectrophotometer following Standard Methods (1989). In the field, two sediment cores were collected from each site. Pore water was extracted from one sediment core, filtered (0.45 µm), and stored on ice for later analysis. In the lab, the second core was dried and used for particle size analysis (%sand, %silt, %clay) following the hydrometer method of Gee & Bauder (1986). Hydrometer readings were taken at 30 sec and 7 hr. Organic matter was determined by heating ground sediment samples (2 g) to 250°C for 1 hr (Liegel et al. 1980). Pore water ammonium-nitrogen analysis was modified from the Solorzano (1969) phenol-hypochlorite method.

Analysis

We used pH vs. calcium plots to determine the influence of each related factor on *Myriophyllum* distributions. By placing lines as boundaries around the "envelope" of plotted points (Hutchinson 1970) for each geographic species group, the general importance of each factor (calcium vs. pH) was determined. All water and sediment variables were ln transformed to normalize distributions (Sokal & Rohlf 1981). We tested for significant differences between the northern and widespread groups for four water (ammonium-nitrogen, calcium, extinction coefficient, and pH) and five sediment (ammonium-nitrogen, % clay, organic matter, % sand, and % silt) variables using a nested analysis of variance (ANOVA). The 35 collection sites were nested within the seven species and the species were nested within the two geographic groups. We then analyzed the water and sediment

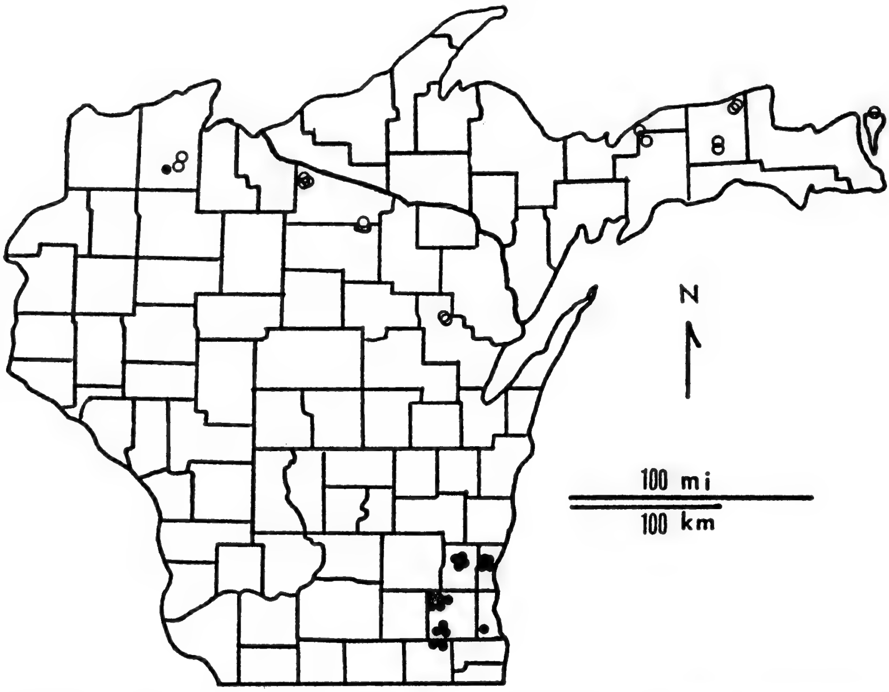

FIGURE 1. Wisconsin and Upper Peninsula of Michigan showing site localities. Open circles are northern species sites, and solid circles are widespread species sites.

variables for significant differences among the seven *Myriophyllum* species using one-way ANOVA and Tukey post hoc tests.

RESULTS

The pH vs. calcium plots indicated that the northern species group (Fig. 2) was generally restricted by water calcium concentration. Within the northern group, one site with *Myriophyllum alterniflorum* had high calcium levels relative to the other northern sites. Conversely, the widespread species group (Fig. 2) seemed to be restricted by pH but had a wide range of calcium tolerance, with the exception of one *M. sibiricum* site with high pH.

The lakes with northern *Myriophyllum* species differed significantly ($p < 0.05$) from lakes with widespread species in five water (calcium, pH) and sediment (ammonium-nitrogen, % silt, % clay) variables (Table 1). Similarly, significant interspecific differences were found for water calcium levels, pH, and sediment ammonium-nitrogen levels (Table 2). However, no interspecific differences were found for % silt and % clay possibly due to the small sample sizes.

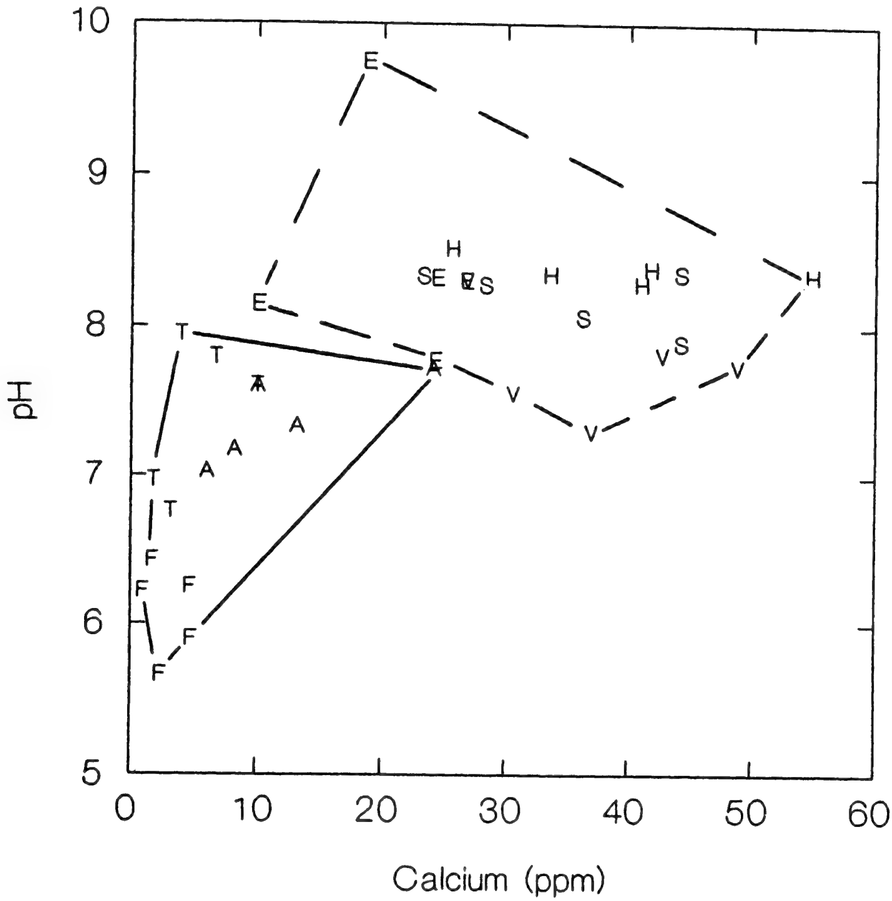

FIGURE 2. Water pH vs. calcium plots for 35 sites in Wisconsin and Upper Peninsula Michigan. The solid line designates the envelope for the northern species group; the dotted line for the widespread species. A = *Myriophyllum alterniflorum*, E = *M. sibiricum*, F = *M. farwellii*, H = *M. heterophyllum*, S = *M. spicatum*, T = *M. tenellum*, V = *M. verticillatum*.

No significant differences were found for extinction coefficients or sediment organic matter between the northern and widespread groups (Table 1); however, significant interspecific differences were found (Table 2). Particle size analysis could not be performed on sediment samples from three sites due to large amounts of organic matter. Light extinction coefficients and organic matter were highly variable for the northern group. *Myriophyllum alterniflorum* and *M. tenellum* were essentially found in clear water lakes with sandy sediments whereas *M. farwellii* grew in brown-stained waters (see Table 2) on organic sediments; however, some exceptions were found. One site with *M. alterniflorum* had brown-stained water and two sites with *M. farwellii* had relatively clear

TABLE 1. Summary of nested ANOVA of nine habitat variables compared between lakes inhabited by northern or widespread *Myriophyllum* species. Means are given as the antilog of the transformed variable. Ca = ppm aqueous calcium, EC = extinction coefficient (m^{-1}), N(aq) = μM aqueous ammonium-nitrogen, N(sed) = μM pore water ammonium-nitrogen, OM = % organic matter.

	Northern Mean (N)	Widespread Mean (N)	F (ANOVA)	Significance
N(sed)	35.37 (15)	325.71 (20)	40.227	p = 0.001
Ca	4.92 (15)	31.16 (20)	20.836	p = 0.006
% silt	5 (13)	16 (19)	14.987	p = 0.012
% clay	4 (13)	8 (19)	11.279	p = 0.020
pH	6.92 (15)	8.18 (20)	8.014	p = 0.037
% sand	82 (13)	66 (19)	6.170	p = 0.056
N(aq)	1.39 (15)	0.80 (20)	2.591	p = 0.168
OM	3.06 (15)	6.69 (20)	1.011	p = 0.361
EC	1.31 (15)	1.10 (20)	0.166	p = 0.700

TABLE 2. Water and sediment variables of 35 sites are seven *Myriophyllum* species. Results are the antilog of the mean (± 1 SD) of five sites/species (* = 4 sites; ** = 3 sites). Values were significant (ANOVA, $p < 0.05$) for Ca, N (sed), pH, OM, and EC (means with same lower case letters were not significant). Ca = ppm aqueous Ca, EC = extinction coefficient (m^{-1}), N (aq) = μM aqueous ammonium-nitrogen, N (sed) = μM pore water ammonium-nitrogen, OM = %organic matter. Alt = *M. alterniflorum*, Far = *M. farwellii*, Ten = *M. tenellum*, Sib = *M. sibiricum*, Het = *M. heterophyllum*, Spi = *M. spicatum*, Ver = M. verticillatum.

	Northern			Widespread			
	Alt	Far	Ten	Sib	Het	Spi	Ver
N (sed)	25(1)a	30(<1)a	59(1)ab	213 (<1)b	462 (1)b	507 (<1)b	225 (1)b
Ca	11.0bc (0.5)	2.5a (0.7)	4.4ab (0.7)	19.8cd (0.4)	38.2d (0.3)	34.3d (0.3)	36.3d (0.3)
% silt	15 (1)	8 (1)**	4 (<1)	14 (1)	12 (1)	17 (1)	26 (1)*
% clay	4 (<1)	6 (<1)**	3 (<1)	7 (1)	8 (1)	8 (<1)	8 (1)*
pH	7.37b (0.04)	6.09a (0.05)	7.40b (0.07)	8.44c (0.09)	8.38c (0.01)	8.19bc (0.02)	7.74bc (0.05)
% sand	73 (1)	80 (1)**	93 (<1)	75 (<1)	65 (<1)	66 (<1)	58 (<1)*
N (aq)	2.1 (0.7)	0.7 (0.4)	1.9 (0.6)	0.7 (1.0)	1.3 (1.2)	1.0 (1.4)	0.6 (1.1)
OM	1.4a (0.5)	15.2bc (1.6)	1.3a (0.4)	3.5ab (0.9)	4.7abc (1.2)	7.6abc (0.5)	16.0bc (1.2)
EC	1.0ab (0.8)	3.3b (1.0)	0.7a (0.4)	1.1a (0.3)	0.8a (0.3)	1.3a (0.2)	1.4ab (0.3)

TABLE 3. General environmental variables under which each *Myriophyllum* species (Spp) is found. Data from published sources and the present study. References (Ref.): Aiken 1981[1], Aiken et al. 1979[2], Almestrand & Lundh 1951[3], Ceska & Warrington 1976[4], Correll & Correll 1972[5], Crow & Hellquist 1983[6], Hutchinson 1970[7], 1975[8], Iversen 1929[9], Muenscher 1944[10], Reed 1977[11], Seddon 1972[12], Spence 1964[13], Swindale & Curtis 1959[14], Voss 1965[15], 1985[16]. Alt = *M. alterniflorum*, Far = *M. farwellii*, Ten = *M. tenellum*, Sib = *M. sibiricum*, Het = *M. heterophyllum*, Spi = *M. spicatum*, Ver = *M. verticillatum*.

Spp	Water	Sediment	Ref.
Alt	acidic-slightly alkaline pH; wide range of Ca tolerance	sandy; low NH_4^+	1, 6, 8, 9, 12-14, 16
Far	acidic pH; soft; brown-stained to clear	sandy; highly organic; low NH_4^+	3, 6, 10
Ten	acidic-slightly alkaline pH; soft	sandy; low NH_4^+	1, 10, 14–16
Sib	wide range of pH and Ca tolerance	sandy-muck; high NH_4^+	2, 5, 6, 10, 14, 16
Het	acidic-alkaline pH; wide range of Ca tolerance	silty-clay; high NH_4^+	6
Spi	Wide range of pH tolerance; hard	sandy-muck; high NH_4^+	2, 3, 6, 7, 9, 11–13
Ver	slightly acidic-slightly alkaline pH; wide range of Ca tolerance	silty-muck; high NH_4^+	2, 3, 7, 8

water. These observations help to clarify the large intraspecific variances found for both of these species.

No significant differences were found for water ammonium-nitrogen or sediment sand content between the northern and widespread groups or among species (Tables 1 & 2). Temporal variations in water ammonium-nitrogen levels occur in eutrophic lakes, whereas these levels are generally low throughout the year in temperate oligotrophic lakes (Wetzel 1983). Water ammonium-nitrogen levels were low at all of the sites, probably because samples were collected late in the growing season. Large variances in sediment sand content were found among the sites (especially for the widespread group). Because numerous sediment collection sites were in urban areas, the large variance in sand content may have been due to anthropogenic input.

DISCUSSION

Hutchinson (1975) has stressed that "The most important chemical dichotomy in the ecology of the plants of freshwaters is that of soft and hard waters." In Wisconsin, limestone and calcareous lake sediments are generally confined to the south, whereas insoluble sandy sediments predominate in the north. Waters above these sediments form a gradient from soft, cold waters in the north to hard, warm waters in the south (Fenneman 1902, Juday 1914, Curtis 1971, Wil-

son 1939). Aquatic plant communities found within this region reflect this gradient (Curtis 1971), as do the congeneric species of *Myriophyllum*.

Clearly, lake water pH and calcium play important roles in the distribution of the seven *Myriophyllum* species examined in this study. In the upper Great Lakes region, milfoil species in the northern group were found at sites with low calcium concentrations and acid-neutral pH. Conversely, species in the widespread group were found at sites with high calcium concentrations and neutral-alkaline pH. As in our region, Swedish lakes show a similar geographical gradient of northern softwater lakes and southern hardwater lakes. Earlier studies of *Myriophyllum* in Swedish lakes demonstrated that *M. alterniflorum* generally occurred in low pH soft water lakes, whereas *M. spicatum* and *M. verticillatum* more typically occurred in harder water lakes with higher pH (Almestrand & Lundh 1951, Hutchinson 1970, 1975). However, Iversen (1929) and Spence (1964) have associated *M. alterniflorum* with moderately-hard to hard waters in Danish and Scottish lakes.

Hutchinson (1975) categorized *Myriophyllum* species into three water hardness groups. Despite his admitted lack of adequate data, he tentatively placed *M. alterniflorum*, *M. farwellii*, and *M. tenellum* among soft water species, and *M. verticillatum* with species of intermediate water hardness; *M. sibiricum* was included among the hard water species. Our data provide some evidence to corroborate Hutchinson's categorization of these species.

Explanations of *Myriophyllum* species distributions based solely on lake water pH and calcium concentrations may be misleading (Sculthorpe 1967). Bicarbonate concentrations and conductivity (associated with pH and calcium concentrations) are also low in soft waters. Higher levels of these four variables are found in hard waters (Hutchinson 1970, Sculthorpe 1967). Optimal photosynthetic rates have been observed for *Myriophyllum spicatum* in bicarbonate solutions; however, under acidic conditions limited rates were observed (Steeman-Nielsen, 1947). These findings led Spence (1967) to suggest that lake water alkalinity was a factor restricting the distribution of *M. spicatum*. Sediment variables, light, and water flow may all affect plant distributions (Sculthorpe 1967). Thus, we included other variables in addition to water pH and calcium concentration to identify habitat differences between northern and widespread species groups.

Physical texture rather than chemical composition is the primary influence of sediments on aquatic plant distributions (Sculthorpe 1967). Sediment texture and chemistry are interdependent; however, sandy (large particle size) or highly organic sediments are relatively nutrient-poor, and silt/clay sediments (small particle size) are relatively nutrient-rich (Hutchinson 1975). In the upper Great Lakes region, the northern species occur on sediments low in silt and clay where ammonium-nitrogen levels are low. Furthermore, the low pH and calcium levels found at these sites indicate that the northern species are restricted to oligotrophic habitats. Sites inhabited by the widespread species had significantly higher levels of silt, clay, and high ammonium-nitrogen levels. Those factors together with the relatively higher levels of pH and calcium indicate that widespread species are found in more meso- to eutrophic sites.

Water and sediment characteristics of the littoral zone are important factors

that in part influence the distribution of rooted, submersed *Myriophyllum* species (Table 3). Interestingly, water pH and calcium characteristics of habitats with species in the northern group are similar in both the upper Great Lakes region and other sites in Europe and North America (Table 3). One exception is the higher calcium content of Scottish waters, compared with the upper Great Lakes region, where Spence (1964) found *Myriophyllum alterniflorum*. Conversely, water pH and calcium characteristics of habitats with species in the widespread group had a more restricted range in the Great Lakes region. Wider ranges of water pH and calcium levels were found when data from European and other North American regions were included.

Although the northern species are restricted to oligotrophic environments in the upper Great Lakes region, tolerance to water and sediment variables may only partially explain their confined distribution. Climate, plant competition, chances of geographical dispersal, and dispersal agents may also affect plant distributions (Aiken et al. 1979, Good 1953, Seddon 1972). While climate may greatly influence terrestrial plant distributions, submersed plants may be less susceptible to climatic extremes of terrestrial habitats, owing to the stable, well-buffered nature of aquatic habitats (Les 1986, Tiffney 1981).

Plant competition has previously been suggested as a factor in aquatic plant distributions, though evidence is indirect. *Isoetes lacustris* and *I. setacea*, confined mainly to oligotrophic habitats, have also been found in eutrophic habitats but are generally excluded from these areas due to their poor competitive ability (Sculthorpe 1967, Seddon 1965). Seddon (1965) found these species in restricted sites where other aquatics could not survive. Similarly, wide ranges of water solute tolerance for several species, including *Littorella uniflora*, were found by Seddon (1972); however, he suggested this species was restricted to nutrient-poor waters due to competition from other species.

Myriophyllum alterniflorum has a wide range of chemical tolerance (Iversen 1929, Seddon 1972, Spence 1964), but seems to be generally restricted to oligotrophic environments in the upper Great Lakes region. This habitat restriction may be due in part to competition; however, many factors can ultimately affect the distribution of one species as discussed above. Interestingly, only one site from this study (Frog Bay, Sugar Island, Chippewa Co., Michigan) was inhabited by both a northern (*M. alterniflorum*) and a widespread species (*M. sibiricum*).

In summary, this study provides data for the categorization of seven *Myriophyllum* species into northern and widespread groups by characterizing some of the typical habitat features in which they are found in Wisconsin and the UP of Michigan. This report also provides habitat data on *M. farwellii* which is rare in Wisconsin and Michigan. Because many aquatic species, including *Myriophyllum*, are overlooked by general collectors (Voss 1972), and limited habitat data for these specimens exist, further habitat analyses are encouraged to expand the base-line habitat data provided by this report.

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ANNOUNCEMENT

NOMINATIONS ARE NOW BEING ACCEPTED FOR THE FIRST ISOBEL DICKINSON MEMORIAL AWARD

The Red Cedar Chapter (RCC) of the Michigan Botanical Club (MBC) is pleased to announce that the Isobel Dickinson Memorial Award fund has reached sufficient levels to be able to make its first annual award (of $100.00) for the best, nominated, student-authored paper published in *The Michigan Botanist.*

Isobel Adkins Dickinson (1921-1993) was a founding member of RCC and served as its Treasurer (1973-1993), Secretary (1989-1993), and At-Large Representative to the MBC State Board (1980-1993). She is fondly remembered by all, and the loss of her battle with cancer (September 26, 1993), is deeply felt to this day. This award has been set up in her memory.

Nominations are now being accepted for articles appearing in volume 35 of *The Michigan Botanist.* To the best of the editor's knowledge, the eligible papers in Volume 35 are: Schulte & Barnes, p. 29; Larson & Henson, p. 38; Thomas, p. 49; and Gerber & Les, p. 75.

CRITERIA ARE AS FOLLOWS: 1) The nominated author/co-author must be at least a half time student in any High School, Adult or Trade School, College, or University. 2) The nominated article must have undergone the standard peer review process and been published in *The Michigan Botanist* in the volume under consideration for a given year's award.

NOMINATIONS CONSIST OF AND MUST INCLUDE EACH OF THE FOLLOWING:

1) Nominee's full name, address, phone number, and E-Mail address.
2) The article's title, volume and issue number, pagination, and date.
3) If co-authored, state what percent of the total effort the student made in the article's (a) research, (b) research funding, and (c) writing.
4) A signed statement from the nominee that (s)he is at least a half time student, and include the school's name, address, and a contact person/advisor's name and phone number and E-Mail address.
5) A brief (paragraph or less) statement of why this article/student should be considered for this award.
6) The name, address, phone number, and E-Mail address of the nominator (self nominations are acceptable).

Final selection will be at the discretion of the Dickinson Award Committee and will typically take place within 6 months of publication of the fourth issue of a given volume of The Michigan Botanist. Announcements and the award will follow shortly thereafter. The committee reserves the right not to make the award for any given year. All decisions of the committee are final.

Direct questions and/or submit nominations to: Patrick F. Fields - Chair, Dickinson Award Committee, Department of Botany and Plant Pathology, Michigan State University, East Lansing, MI 48824-1312 or phone: (517) 355-4692 or E-Mail: "fieldspa@pilot.msu.edu".

THE UNNECESSARY CONFUSION BETWEEN *PORELLA PLATYPHYLLA* AND *P. PLATYPHYLLOIDEA* (HEPATICAE) IN MICHIGAN HERBARIUM COLLECTIONS

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ABSTRACT

The identity of *Porella platyphylla* (L.) Pfeiff. and *P. platyphylloidea* (Schwein.) Lindb. is confused in the literature, and many Michigan herbarium specimens are misidentified. However, they are clearly separable by having either bispiral (*P. platyphylla*) or unispiral (*P. platyphylloidea*) elaters when these are present. However, only 16% of 498 collections examined bore capsules with elaters. A scoring system was devised to assess the usefulness of these and other characteristics in recognizing these species. Measurements were made of dorsal lobes, ventral lobes, underleaves, stems, perianth cilia, and elaters. The application of the scoring system indicates that female plants of the two species are distinct, that elaters and the shape of ventral lobes are the most useful characteristics in recognizing them, that male plants of the two species are quite similar, and that *P. platyphylla* is more frequent in eastern and north-central North America than *P. platyphylloidea*, which ranges more widely, but is more frequent in the southeastern United States. When several characters are used, female plants of both species can usually be recognized. Male plants can not be reliably separated by any character yet found.

INTRODUCTION

Porella platyphylla (L.) Pfeiff. and *P. platyphylloidea* (Schwein.) Lindb. are relatively large leafy liverworts. Their identity has been confused, and misidentifications are common. The situation was certainly not helped when Steere (1940) published a drawing showing characteristics close to *P. platyphylla* in his much used *Liverworts of Southern Michigan* and labeled it *P. platyphylloidea.*

The problem has a long history. In his monograph on the North American species of *Porella*, Howe (1897) treated the two names as synonyms and commented that "Transitional conditions occur so frequently that we believe nothing is gained by an attempt at separation." In 1900 Schiffner, as quoted by Evans (1916), considered the true *Madotheca* (*Porella*) *platyphylla* to be "totally lacking in America, being everywhere replaced by M. platyphylloidea." Schiffner did, however, single out the elaters as particularly useful in recognizing the two species. According to Evans (1916), elaters of *P. platyphylla* (See Fig. 1) have two spirals which are "continuous at the extreme ends and form loops." In *P. platyphylloidea*, the elaters "normally show a single spiral band throughout their length; in some cases two spiral bands are present in the middle of the elater but only one extends to each end" (See Fig. 2). Up to now, this has been the only reliable character for separating these two species.

Evans (1916) examined numerous plants from both European and North

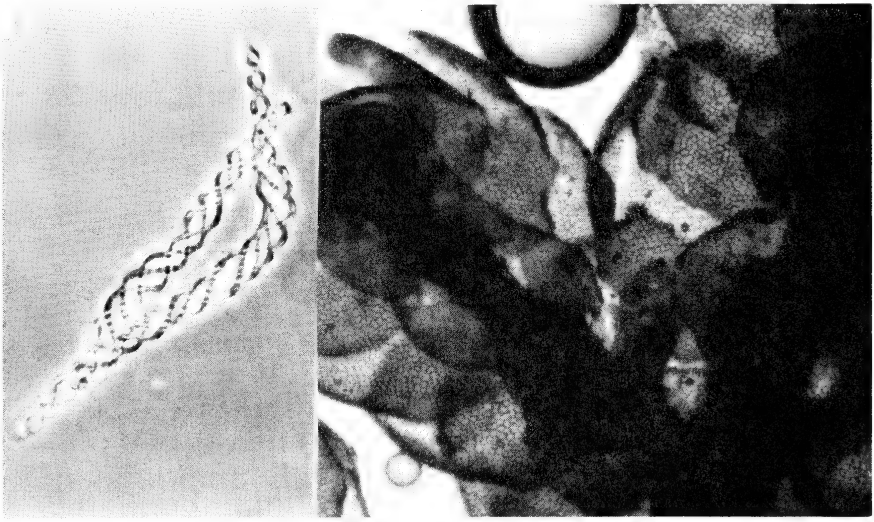

FIGURE 1. Bispiral elaters (440×) and ventral view (30×) of *P. platyphylla*. Note narrow ventral lobules reflexed along one side.

American collections, all having bispiral elaters, and showed that the vegetative characters relied upon by some earlier writers are quite variable. He described his "inclination" to restrict the use of the name *P. platyphylla* to plants with bispiral elaters and then reported, however, that he "now feels convinced . . .

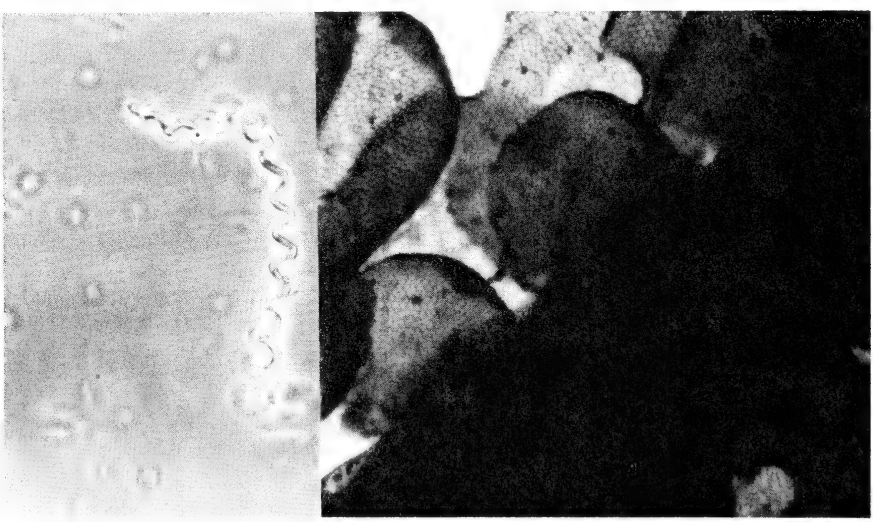

FIGURE 2. Unispiral elaters (440×) and ventral view (40×) of *P. platyphylloidea*. Note broad ventral lobules reflexed across the top.

that the true *P. platyphylla* is much rarer than supposed, being largely replaced by the closely related *P. platyphylloidea*." Frye and Clark (1946) treated *P. platyphylloidea* as a variety of *P. platyphylla* and observed that "there was so much confusion between *P. platyphylla* and its variety *P. platyphylloidea* that all North American material named before the publication of Evans' paper on the genus in 1916 should be re-examined."

Schuster (1953) recognized both species but cautioned that "sterile plants are often very difficult to place, and cannot always be determined with certainty." Following Evans (1916), he relied on elaters as the critical character separating the two species but incorrectly concluded that "in general, *P. platyphylla* is by far the less frequent species in North America." Later Schuster (1980) advised that specimens representing intergradation in vegetative characters" . . . should not be named *unless elaters can be studied*" (emphasis in Schuster, 1980).

Crum (1991) admitted to "having been perplexed by the problem for half a century." His key distinguishes between the two species on the basis of the shape of the ventral lobes of the leaves, but his text points out that "the width and shape of ventral leaf lobes are variable." After indicating that "reproductive features are presumed to be more reliable as taxonomic characters," he lamented that "unfortunately, however, neither species fruits very often."

The purposes of the present study were to examine numerous collections of both species, determine the percentage of those bearing capsules with elaters and, using those, to examine the amount of variability in the vegetative gametophytic characteristics, toward the end of assessing the reliability with which sterile collections can be identified.

METHODS

All available collections of both species were borrowed from MICH, MSC, MCTC, MTU, NM, and WMU to supplement those gathered in the field by the author. In all, 498 collections were assembled for examination. A preliminary examination indicated that only 80 of those collections (16%) bore sporophytes. Among the 418 collections without sporophytes, 251 were labeled *P. platyphylla* and 167 were named *P. platyphylloidea*.

A scoring system based on the characteristics and measurements given by Schuster (1949, 1953, & 1980) was designed (Table 1). In this scoring system stem width, lobule size, lobule shape, perianth cilia, and elaters were given a score of zero if the character or measurement was typical of *P. platyphylla*, two if of *P. platyphylloidea*, and one if intermediate. Thus, a plant that fits all of the characteristics of *P. platyphylla* would score zero and of *P. platyphylloidea*, ten. Both male and female plants were examined when present in the collections.

RESULTS AND DISCUSSION

Given the location of the herbaria from which the collections were borrowed, there is a clear bias toward the north-central United States and adjacent Canada in the samples studied. Of the 498 collections examined (Table 2), 324 came from this region (257 from Michigan, 52 from Ontario, and 15 altogether from Minnesota, Illinois, and Wisconsin). Of the remaining 174 collections, 62 came from nine states in the northeastern United States and one province in eastern

TABLE 1. Scoring system for various characteristics of *P. platyphylla* and *P. platyphylloidea*. Measurement ranges are from Schuster (1949, 1953, 1980). All measurements are given in micrometers. Measurements were made through use of a calibrated ocular micrometer.

	P. platyphylla	*P. platyphylloidea*
Score	0	2
Stem Width	320–360 (Intermediate) 370–440.	450–600.
Lobule Size	550–650 long × 370–410 wide (Intermediate) 660–840 long × 420–690 wide.	850–1000 (–1050) long × 700–725 (–800) wide.
Lobule Shape	Narrowly ovate-triangular to lanceolate. Width considerably less than underleaf. Somewhat pointed.	Oblong-lingulate to ovate. Width sub-equal to underleaf. Apex usually broadly rounded.
Perianth Cilia	Rather distant to somewhat approximate. Short teeth or cilia (teeth usually 2–3 celled), occasionally (rarely) geniculate, branched, 5–7 cells long.	Densely ciliate, crowded to approx. 2–5 cells long × 1 cell wide. Straight or, more commonly, variously contorted or geniculate, rarely branched.
Elaters	Wholly 2-spiral or 2-spiral at least at tips.	1-spiral throughout, (infrequently) partially 2-spiral near the middle, but the ends never 2-spiral.

TABLE 2. Source regions and ratios of 498 *P. platyphylla* and *P. platyphylloidea* collections examined.

Region	*P. platyphylla* (1)	*P. platyphylloidea* (2)	Total	Ratio (1)/(2)
North Central U.S. & Adj. Canada	250	74	324	3.4:1
Western U.S. & Adj. Canada	11	4	15	2.8:1
Northeast U.S. & Adj. Canada	43	19	62	2.3:1
Southeast U.S.	27	38	65	0.7:1
North American Totals	331	135	466	—
Europe	32	0	32	—
Total of All Collections	363	135	498	—

Canada, 65 were from 13 states in the southeastern United States, 15 from 8 states in the western United States and two provinces in western Canada, and 32 from 9 countries in Europe. Thus, although the bulk of the collections come from north-central North America, other parts of the geographic range of the two species are represented in the material studied.

While only 16% of the collections bore capsules with elaters, almost all collections had discernible male and/or female plants. The archegonia were easily recognized, even at 20× magnification, as was the shape of the compact antheridial branches.

Of the 80 collections with sporophytes, 60 had bispiral elaters and were hence *P. platyphylla*, and 20 had the unispiral elaters of *P. platyphylloidea*. Sixteen of the 60 (27%) *P. platyphylla* collections were mislabeled, whereas 12 of the 20 (60%) of the *P. platyphylloidea* collections were incorrectly labeled. This level of misidentification certainly illustrates the confusion about which species is more common in North America that has led to comments like those of Schuster (1953) that *P. platyphylla* has a "distribution much like *P. platyphylloidea*, but distinctly less common in Eastern United States." Exactly the opposite is true.

Crum (1991) acknowledged that *P. platyphylla* is "much more common" than *P. platyphylloidea* in Michigan. Examination of the 498 collections used in this study makes it clear that *P. platyphylla* is *the* common *Porella* in the Great Lakes region. Among the 80 collections from which elaters could be obtained, *Porella platyphylla* is decidedly more common. Distribution maps based on these collections for the two species (Figure 3 and 4) show a northcentral U.S.-southern Canada distribution for *P. platyphylla* and a broad scattered, southeastern distribution for *P. platyphylloidea*.

As indicated in Table 3, the average score for *P. platyphylla* collections was 1.8 and for *P. platyphylloidea* collections, 8.2. The widest divergences in scoring were seen with regard to elaters, perianth cilia, and lobule shape. Less divergence was seen in the scores for lobule size and stem width, as these tended to vary in both species with the degree of robustness of the plants, indicating that these characters are not useful in discerning the species.

Some vegetative characteristics (Table 4) were less useful in recognizing the two species. Usefulness of a character was based on the extent to which the ranges, means, and standard deviations overlapped. For example, stem and underleaf width ranges and averages are very similar for the two species. The length of ventral lobules on female main stems shows considerable overlap. The width of ventral lobules is more useful, especially when considered as a length:width ratio. Perianth cilia were less useful as they were often degraded or broken, even when great care was taken in making preparations.

If identifications are based on the length:width ratio of ventral lobules *on the main stem* of female plants, few errors will be made. Another characteristic, frequently illustrated but rarely commented on, is that the narrower ventral lobules of *P. platyphylla* have margins recurved *from the sides* of the lobule, particularly at the apex. This gives the lobules of *P. platyphylla* their characteristic pointed appearance on the main stems of female plants (Fig. 1).The broader ventral lobules of *P. platyphylloidea* are reflexed *across the apex* of the lobule giving them a characteristic blunt appearance (Fig. 2). When the nature of the margins is combined with length:width ratios of the ventral lobules of female main stems the likelihood of error is further diminished. All 80 elater-bearing plants were first identified using these vegetative characteristics. When identifications were

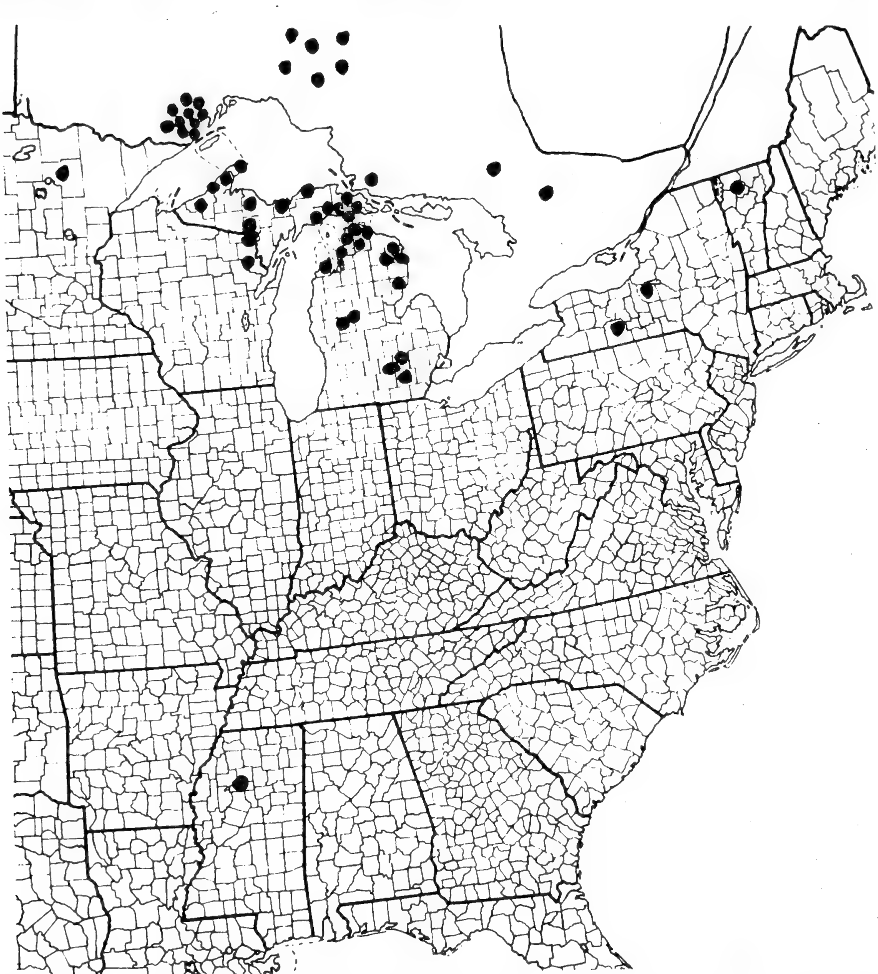

FIGURE 3. Distribution of the 60 North American *Porella platyphylla* (L.) Pfeiff. collections examined and determined to have bispiral elaters. The number of dots is less than the number of collections examined since several collections were examined from some sites.

checked against the elater data, it was clear that all 80 had been correctly identified!

As the data in Table 4 show, the length, width and length:width ratios are less discriminatory when lobules are compared from female *branches* and do not work very well when male plants are used, regardless of whether one uses main stems or branches. Thus, lobules on female main stems give length:width ratios of 2.08 for *P. platyphylla* and 1.43 for *P. platyphylloidea*, whereas the comparable figures for lobules on female branches are 2.04 and 1.65. Both are useful but the main stem lobules enable more reliable discernment. The length:width ratios

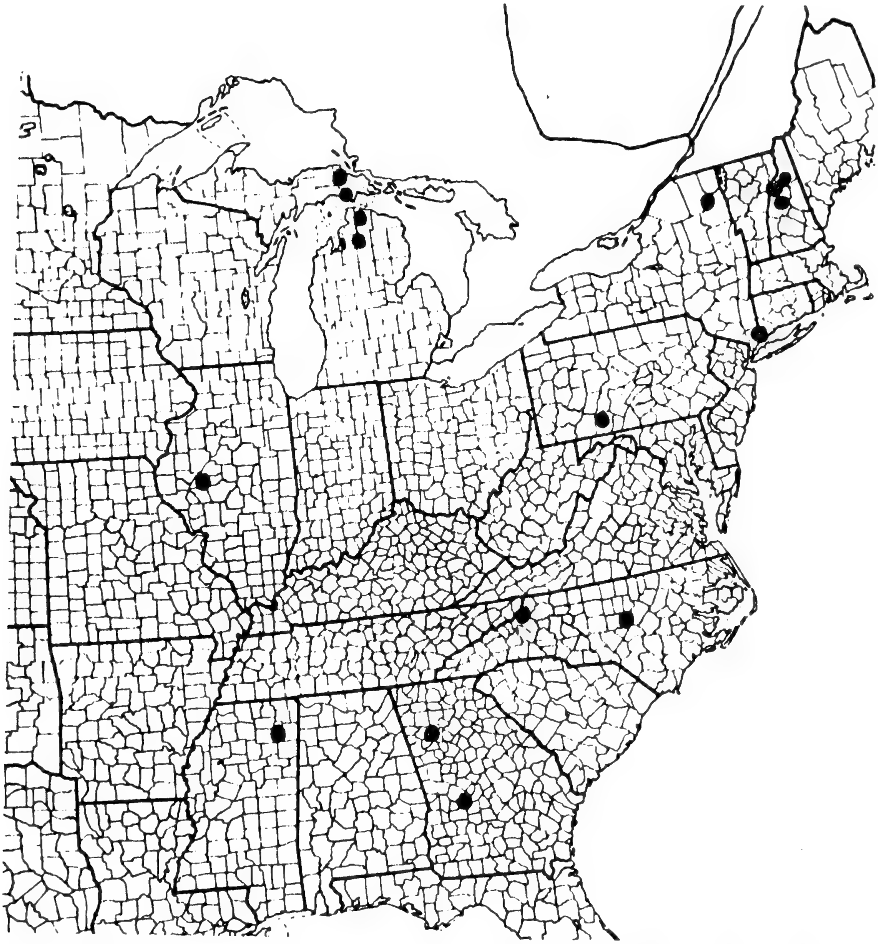

FIGURE 4. Distribution of the 20 North American *Porella platyphylloidea* (Schwein.) Lindb. collections examined and determined to have unispiral elaters. The number of dots is less than the number of collections examined since several collections were examined from some sites.

TABLE 3. Average scores (0–2) for various characteristics of *P. platyphylla* and *P. platyphylloidea* based on the measurements of plants from 60 collections with bi-spiral elaters (*P. platyphylla*) and 20 collections with unispiral elaters (*P. platyphylloidea*).

Characteristics	Average Score *P. platyphylla*	Average Score *P. platyphylloidea*
Stem Width	0.85 ± 0.7	1.15 ± 0.7
Lobule Size	0.8 ± 0.6	1.3 ± 0.6
Lobule Shape	0.06 ± 0.25	1.8 ± 0.4
Perianth Cilia	0.06 ± 0.25	1.9 ± 0.3
Elaters	0	2
Overall Score	1.8 ± 1.1	8.2 ± 1.5

TABLE 4. Measurements of various vegetative characteristics of elater-bearing *P. platyphylla* and *P. platyphylloidea*. All measurements are given in micrometers. The most useful characters are marked by an asterisk.

	P. platyphylla				*P. platyphylloidea*			
Characteristics	n	range	ave.	st. dev.	n	range	ave.	st. dev.
female main stem width	60	230–660	440	85	20	275–605	420	87
Male main stem width	33	209–660	356	92	11	242–440	350	62
Female main stem underleaf width	59	335–990	679	144	20	462–880	681	139
Female main stem lobule length	60	350–1100	727	136	20	550–1045	786	144
Female main stem lobule width*	60	143–583	365	107	20	330–880	570	161
Female main stem lobule l:w ratio*	60	1.35–3.85	2.08	0.47	20	1.08–2.17	1.43	0.27
Female branch lobule length	55	200–847	528	124	20	407–880	605	125
Female branch lobule width	55	100–495	264	75	20	220–550	605	125
Female branch lobule l:w ratio	55	1.49–2.67	2.04	0.31	20	1.33–2.14	1.65	0.24
Male main stem lobule length	31	350–990	597	140	10	475–1100	684	171
Male main stem lobule width	31	150–484	306	86	10	198–770	423	145
Male main stem lobule l:w ratio	31	1.3–4.0	2	0.5	10	1.3–2.9	1.7	0.5
Male branch lobule length	29	200–550	407	87	10	355–665	482	98
Male branch lobule width	28	90–330	205	59	10	209–440	299	70
Male branch lobule l:w ratio	28	1.3–4.0	2.1	0.6	10	1.1–2.0	1.7	0.3

for lobules on the main stem of male plants are 2.0 and 1.7, and those on the branches of male plants, 2.1 and 1.7. These data suggest that identification should be restricted to the use of lobules on the main stems of female plants. No satisfactory way has yet been found to critically identify male plants of the two species.

CONCLUSIONS

Porella platyphylla and *P. platyphylloidea* can be recognized by the bispiral elaters of the former and the unispiral elaters of the latter. Although this characteristic provides a clear separation, it is of limited usefulness in that 84% of the specimens were not bearing capsules. The two species can also be recognized, however, by the shape of the ventral lobules on the main stems of female plants, which are narrower and reflexed along one side in *P. platyphylla*, and broader and reflexed across the apex in *P. playphylloidea*. Although male plants of the two species cannot be separated, the confusion in the literature and the frequent misidentification of collections are unnecessary.

ACKNOWLEDGMENTS

I would like to thank the curators of the herbaria from which the collections were borrowed, Dr. Howard Crum of the University of Michigan Herbarium for his interest in the study, Drs. Crum and Norton Miller of the New York State Museum for their suggestions for improvement of the manuscript, and Western Michigan University for granting sabbatical leave during which this and other studies were undertaken at the University of Michigan Herbarium. Special thanks go to Dr. Rob Eversole of the Western Michigan University Biological Sciences Department's Imaging Center for taking the photomicrographs.

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THE BIG TREES OF MICHIGAN
16. Salix nigra Marshall

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The largest known Black Willow in Michigan is located on the State Hospital grounds in Traverse City (Grand Traverse County) of Michigan's Lower Peninsula.

Description of the Species: The Black Willow is a member of the willow family (Salicaceae). In this family, the genus *Salix* is distinguished from the genus *Populus*, the only other genus in this family in Michigan, by having a single exposed bud scale. Furthermore, willow leaves in all of our species are linear to lanceolate in shape (generally at least twice as long as wide) whereas poplar leaves tend to be broader, ranging from ovate to triangular (generally less than twice as long as wide). Many willow species are shrub-alike. *S. nigra* forms trees.

Location of Michigan Big Tree: Michigan's largest known Black Willow is located on the grounds of the State Hospital in Traverse City, Michigan (Sec. 9, T27N R11W). The tree can be reached by taking U.S. 31, which becomes Division St. in Traverse City, to the traffic light at the entrance to the State Hospital grounds. Turn onto 11th St. and follow it 0.3 mi. to Silver Street. Bear left and follow Silver St. 0.4 mi. to the tree. The State Champion is one of a pair of Black Willows, one on each side of the road.

Description of Michigan's Big Tree: The trunk of the tree separates into five trunks at 4′10″ above the ground. The tree is solid and healthy. A large branch has been broken off on the NE side. The circumference of the tree at breast height was measured on July 27, 1995 with Dr. John Spencer of Traverse City, at 400″ (1016 cm) [diameter = 127″ (323 cm)]. The crown spread was measured at 92′ (28 m), substantially less than the 136′ (41 m) previously recorded by Paul Thompson and probably a result of the loss of the large branch on the NE side. The height was measured at 76′ (23 m), again substantially less than the 114′ (35 m) recorded by Thompson, reflecting other branch losses. Although height and crown size have decreased significantly, its State Champion status remains secure because State Champion trees are determined by the circumference of the trunk at breast height alone.

INVITATION TO PARTICIPATE

If you would like to join us in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B.

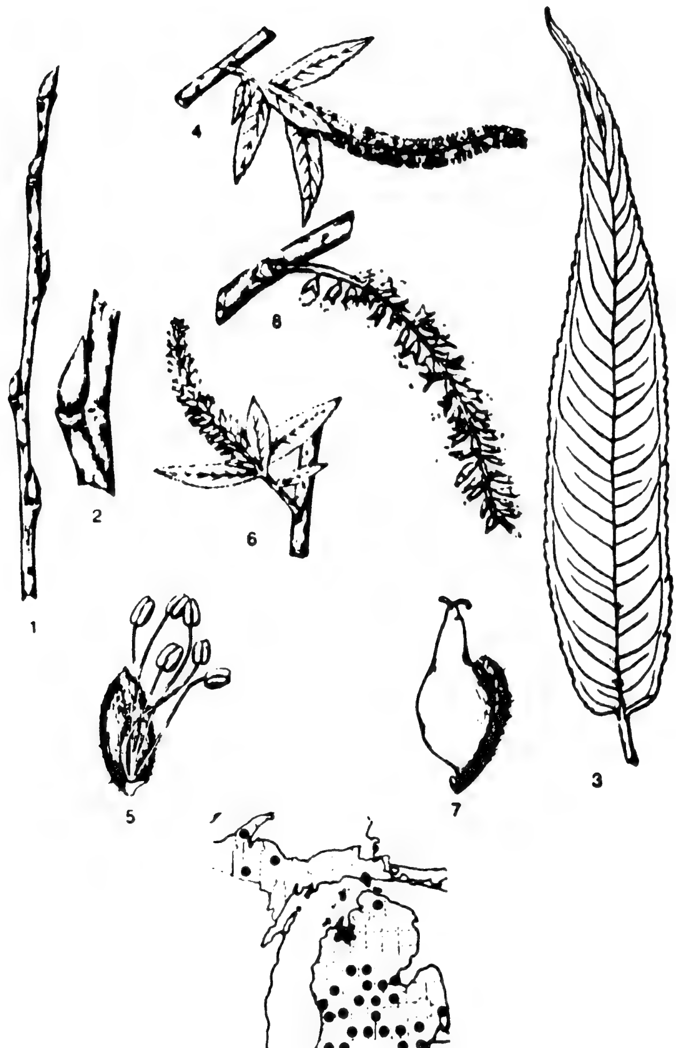

FIGURE 1. Documented distribution in Michigan and characteristics of Black Willow. Map is from Voss (1985). The star indicates the location of Michigan's Big Tree. Illustrations are from Barnes & Wagner (1991). 1. Winter twig, ×1; 2. Portion of twig, enlarged; 3. Leaf, ×1; 4. Male flowering shoot with catkin, ×1; 5. Male flower, enlarged; 6. Female flowering shoot with catkin, ×1; 7. Female flower, enlarged; 8. Fruiting catkin with capsules, ×1.

Ehrle for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property.

DEDICATION

This series of articles is dedicated to the memory of Paul Thompson, Michigan's Big Tree Coordinator for over 40 years, who died in 1994.

LITERATURE CITED

Barnes, B.V., & W.H. Wagner, Jr. 1991. Michigan Trees. A Guide to the Trees of Michigan and the Great Lakes Region. Univ. of Michigan Press, Ann Arbor. viii + 383 pp.

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ANNOUNCEMENT

NATURAL AREAS CONFERENCE, 6–10 OCTOBER, 1998

The 25th Annual Natural Areas Conference will be held at Mission Point Resort on Mackinac Island, Michigan, from 6–10 October, 1998. The theme of the meeting is "Planning for the Seventh Generation", reflecting the participation of Native Peoples representing several Great Lakes and other tribes. Primary topics will include a discussion on the past, present, and future of natural areas, and the role of natural areas in conservation planning and sustainable development. The Mackinac Straits area, connecting Lakes Huron and Michigan, epitomizes both current threats such as shoreline development pressures and current innovative efforts in strategies such as ecotourism. Field trips (3–5 October) to many nearby natural areas will feature a wide variety of habitats, from sand dunes and interdunal wetlands to limestock bedrock communities and sinkholes to forests and peatlands.

For more information, contact: Great Lakes Natural Areas Conference, P.O. Box 30180, Lansing, MI 48909-7680, (517) 241-2974, or consult:

http://wildlife.dnr.state.mi.us/HomePages/Meetings/Natural_Areas_1998.

THE BIG TREES OF MICHIGAN
17. Pinus nigra Arnold var. austriaca (Hoess) Aschers

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The largest known Austrian Black Pine in Michigan is located at Michigan State University in East Lansing (Ingham County) of Michigan's Lower Peninsula.

Description of the Species: The Austrian Black Pine is a member of the Pine family (Pinaceae). In this family, the genus *Pinus* is distinguished from other genera of the family growing in Michigan by having its needle-like leaves born in clusters or fascicles, with 2–5 leaves per fascicle (Fig. 1). The Austrian Black Pine can be distinguished from other pines which grow in the state by its long (10–15 cm) stiff leaves borne in 2's and not breaking cleanly when bent; nearly black bark, particularly in older trees; and 5–8 cm long cones. Although the Austrian Black Pine is a native of Europe, it is a popular ornamental in Michigan, and many of the larger specimens in the state are associated with homesteads or other historic sites.

Location of Michigan's Big Tree: Michigan's State Champion Austrian Black Pine is located at Michigan State University in East Lansing, Michigan. The tree can be reached by turning south from Grand River into the Abbott Road entrance to the campus, going one block to West Circle drive and looking for the pine to the east of this location on the south side of West Circle and directly across from the Student Union. The tree grows within 5 meters of the road.

Description of Michigan's Big Tree: The tree appears healthy although the larger of the two trunk sections has been cut at an angle, 4.5 feet above the ground. The circumference of the tree at breast height was first measured in October 1996, with Cory Counard, at 138″. Later, with Paul Swartz and Frank Telewski of Campus Parks and Planning, the height was recorded at 65′ and the crown spread at 40′. The tree is believed to have been planted by M.S.U. botany professor W. J. Beal, who established at Michigan State University in 1873, the oldest continuously active botanical garden in the United States.

Other large Austrian Black Pines that can be found in Michigan include a 128″ (girth) pine 3 miles north of Stockbridge, Ingham County, a 119″ tree at the State Hospital in Traverse City, Grand Traverse County, a 118″ pine at the Mt. Hope Cemetery south of Lansing in Ingham County, and a 116″ tree at the Heritage Square Antique Mall located at 36821 Ashley Road (23 Mile Road) in Macomb County.

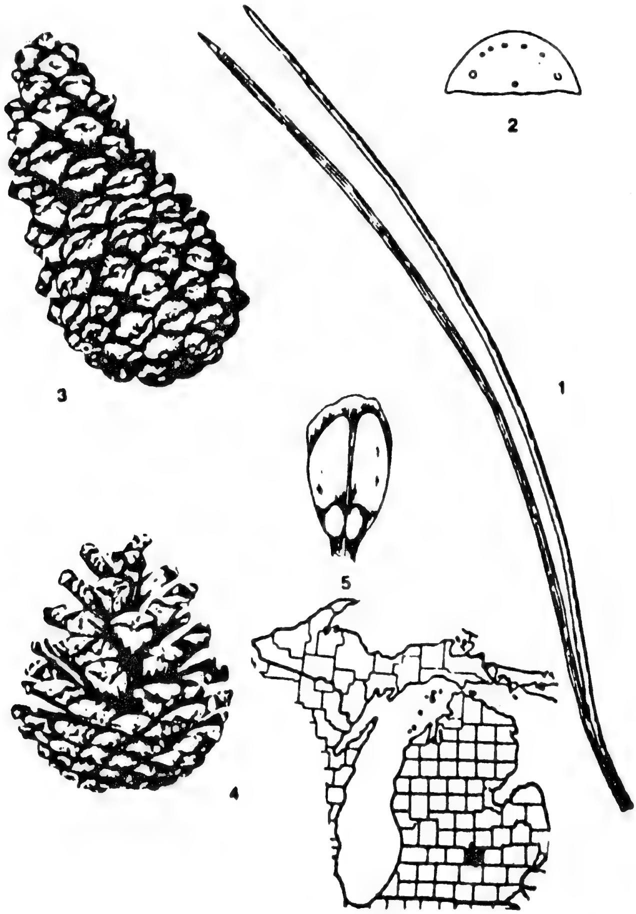

FIGURE 1. Map showing the location and illustrations showing the characteristics of the Austrian Black Pine. Illustrations are from Barnes & Wagner (1991). 1. Cluster of leaves, ×1; 2. Cross section of leaf, enlarged; 3. Unopened cone, ×1; 4. Partly opened cone, ×1/2; Cone scale with seeds, ×1.

INVITATION TO PARTICIPATE

If you would like to join us in extending this series of articles by visiting and describing one or more of Michigan's Big Trees, please contact Elwood B. Ehrle for help with locations, specifications for taking measurements, and assistance with the manuscript. The Michigan Botanical Club encourages your involvement in this activity. Please remember to ask permission before entering private property.

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REVIEWS

CONTEMPORARY PLANT SYSTEMATICS, 2nd Ed., Dennis W. Woodland. 1997. xiv + 619 pages + CD-ROM; paperback. Andrews University Press, Berrien Springs, Michigan 49104. Price $59.95 + $3.00 shipping.

The first edition of this work (1991) was reviewed in *Michigan Botanist* 30(3): 132–134. One of the lines in that review, ". . . written in a friendly, direct style," is reproduced on the back cover of this second edition. It was true then and it's still true.

The present edition is paperback and 37 pages longer. The inflation that typically occurs in textbooks has barely occurred here. The cover is a kind of plasticized paper, very comfortable in the hand. The cover illustration, identified on p. ii simply as "denudata is, I think, *Magnolia denudata* Desr., from China. It is most aptly chosen, given that Cronquist's magnolian scheme is used for the systematic arrangement of the families. As before, the families are each given a page, occasionally a bit more.

There are many unusual features of the book. It is the only 20th-century science book I have seen with a calm, sensible discussion of creationism (p. 419) as an explanation for organic diversity, and a clear statement that creationism is not a testable hypothesis. The book encompasses vascular plants, not just flowering plants. As I commented a few years ago, the inclusion of life cycle diagrams is helpful. Prominent botanists are pictured, which helps, when you are trying to connect a phylogenetic scheme to a person. Neither in the first nor in second edition is there any consideration of agamospermy as it affects determining a name for a plant. There is a fine discussion on the subject of naming a plant versus classifying it. This should be required reading for all students—and newspaper reporters.

The family treatments are synoptic, not exhaustive, of course, and space prevents citing sources for every statement. Still, there are some oddities: *Welwitschia* has but one species (p. 101), and so far as I can tell, its name is *Welwitschia mirabilis* Hooker f. At least that's the name I find in every reference at hand, including the International Code of Botanical Nomenclature, where the generic name is conserved. Cactaceae are said to comprise 30-200 genera—is there truly that much difference of opinion about generic delimitation in the family?

It would be most laborious to run a spell check on a document like this, because thousands of Latin names would not be in the lexicon, and the darned speller would stop at every one; that surely accounts for the typos here and there—nothing major or troublesome.

Potentially, one of the very nicest features of this second edition is the CD-ROM with color pictures of over 800 genera, with over 3,000 color photographs. It is titled "Photo-Atlas of the Vascular Plants." It is included in a pocket inside the back cover. Period. There are no instructions, though its label clearly states it requires Windows 95 or Mac System 7.x, and it is not kidding. Don't bother trying it in Windows 3. 1, because nothing happens. So I got Win-

dows 95 installed, and tried to access the disk. The disk totally locks up my computer, accompanied by dire error messages. I suspect the fault lies with my computer, not with the disk, but I have no way to tell.

There are readable text files, which you can most simply bring up through your word processing program. If you are more computer jock than botanist (my balance falls just the other way), you can probably make sense of such arcana as File Transfer Protocols and the like. There apparently exists some way to bring up a picture in Windows 3.1, but it escapes me how. There is reference to a website, where you can see most of (or all) the same pictures. I went there.

At the website, whose address is http://www.wisc.edu/botany/virtual.html, click on "Vascular Flora of Wisconsin." Some of the pictures I happened to click on were truly excellent, like a closeup of *Psilotum* showing the enations and the trilobed sporangia. You're right, *Psilotum* has nothing to do with the vascular flora of Wisconsin, but no matter. If this is a fair sample of what the CD-ROM shows, as one of the text files on the CD-ROM says it is, then this is a fine package. The pictures on the CD-ROM are not referenced in the textbook itself, but the names are the same, so it should be straightforward to discover whether a given taxon is pictured.

There's a very ample glossary (where you can find stuff like "Pohlstoffe), and one of the best features of the book is Appendix II, Floras of the World. This cannot be exhaustive, of course; one is pleased that Part III of Voss' Michigan Flora got included in the update from edition one, and it should bother no one that a second edition of Vascular Plants of South Dakota appeared in 1985, but only the first edition of 1976 is mentioned—there is simply too much going on for any author to keep track of all of it.

"This book is dedicated to all students with a sense of wonder" (p. ii). It deserves to find its way into many eager hands.

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IN VITRO METHODS FOR CONSERVATION OF PLANT GENETIC RESOURCES. John H. Dodds (editor). Chapman and Hall Publishers, London, United Kingdom. 1991. Pp. 1–247. Available in USA from Van Nostrand Reinhold Publishers, 115 5th Avenue, New York, N.Y. 10003.

In this era of renewed efforts to save rare, endangered, and threatened plant species (and their natural habitats) from destruction, this book is very timely. It is excellent in its coverage of the history of *in vitro* (meaning "in glass") plant conservation; storage of plantlets, shoots, and callus tissue for several weeks up to 6 yrs. at reduced temperature near, but above, freezing without loss of viability; low temperature storage of isolated plant shoot tips and buds (also possible

with plant callus and cell suspensions) at temperatures of liquid nitrogen (–196°C!), referred to as *cryopreservation*; genetic stability of plants stored at zero temperatures; and applications of these methods for conservation of potato germplasm, cassava germplasm, sweet potato germplasms, and tree crop species. What is missing, however, is a long-needed, thorough treatment of *in vitro* methods for the conservation of non-cultivated, naturally-occurring plants, both woody and herbaceous, which are rare, threatened, or endangered in their natural habitats! For those interested in the application of such *in vitro* methods to cultivated crop species, this book is quite good; but even here, it fails to treat many horticultually important ornamentals (e.g., daylilies, roses, Pelargoniums, strawberries, and tropical house plant species) which certainly deserve as much attention as cassava (*Manihot esculenta*), white potato (*Solanum tuberosum*), and sweet potato (*Ipomoea batatus*)!

SEED DORMANCY and GERMINATION. J. W. Bradbeer. Blackie Academic & Professional, an imprint of Chapman & Hall Publishers Glasgow, United Kingdom 1988.

This tidy little paper back is aimed at the "tertiary" level of plant biology undergraduate students. However, it may also be useful to teachers of plant biology at high school and college levels. It contains a wealth of information on seed biology and seed germination strategies; mechanisms of seed dormancy and artificial ways to break seed dormancy; seed banks in the soil; seed production and dispersal; seed viability and longevity; seed technology; and protocols for the investigation of seed biology of the natural flora of a temperate zone. A discussion of the ways by which seed dormancy is broken under *natural conditions* would also have been helpful, especially for those interested in plant ecology. However, this omission does not detract from the general usefulness of this little volume for both students and teachers of plant biology who want to know more about seeds, seed dormancy, and seed germination.

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MICHIGAN LICHENS. Julie Jones Medlin. Cranbook Institute of Science Bulletin 60. ix + 98 pp. Paperback. 1996. Cranbrook Institute of Science, Bloomfield Hills, MI. $12.00 + $1.25 shipping and handling.

In high school and again in college you were told there are three kinds of lichens—crustose, foliose, and fruticose—and nothing more! Actually lichens are remarkably diversified and very numerous. They may be scabby, leafy, bushy, powdery, hairy, or none of the above! Some are mere black dots, and others are beautiful, bizarre, or even grotesque. This little book of beautiful color photographs gives the "look" of 82 Michigan species. Going from this introduction you can look around and see a large variety of lichens, especially in northern Michigan and away from atmospheric pollution. You might then wish to get Hale's *How to Know the Lichens*. You will see that most lichens can be named

at sight. You might sometime make some simple chemical tests, really idiot chemistry, or look at spores, but you can usually cheat your way through a key to species without going to the bother. The message I bring is this: Lichens are easy. Lichens are fun!

Some of Julie Medlin's photographs are spectacular. I particulary admire those of *Arthonia* and *Anaptychia*. The ones of *Cladonia arbuscula* and *Evernia mesomorpha* are less impressive, though acceptable. *Pseudevernia consocians* is covered with isidia, except in this photo! I wonder about that one. *Cladonia furcata* is said to be sparsely squamulose (scaly), but the picture is busy with scales. Unfortunately, some of the lichens were photographed dry, others wet. Because the wet/dry aspects can be quite different, it would have been nice to know.

My criticisms should not be taken too seriously. Go buy the book and enjoy it and use it or give it to someone who will!

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NOTEWORTHY COLLECTIONS

MINNESOTA AND WISCONSIN

LYSIMACHIA VULGARIS L. (Primulaceae). Garden Loosestrife.

Previous knowledge. *Lysimachia vulgaris* is native to Eurasia, where it grows in fens and wet meadows (Komarov 1952, Tutin et al. 1972). In North America *L. vulgaris* is grown as an ornamental and occasionally escapes from cultivation (Gleason & Cronquist 1991). *L. vulgaris* has been reported outside of cultivation from Delta and Wayne Counties, Michigan (Voss 1996), and from several counties in southern or eastern Wisconsin (N. Harriman, pers. comm.; M. Wetler, pers. comm.). We are not aware of other collections from the upper Great Lakes.

Significance. Vigorous colonies of *L. vulgaris* were found at two different locations in Duluth, the first reports of escapes of this species for Minnesota. Both colonies are near roads and receive several hours of direct light each day. One colony grows at the base of a slope in permanently wet soil (*Walton 238*). The other colony (*Walton 1103*) grows in moist to mesic soil near the location of a former commercial greenhouse, where *Clematis terniflora* has also been found (see below). Both colonies of *L. vulgaris* were observed to produce abundant seeds. This, plus the fact that the plant can also increase by rhizomes, may enable the species to continue to spread both within and between wetlands.

MINNESOTA. ST. LOUIS CO.: springy seepage at base of slope, E side 11th Ave. E and Skyline Drive, Duluth, SW1/4 SE1/4 Sec. 28, T50N R14W, 6 Sept 1992, *Walton 234* (DUL); 4 Oct 1992, *Walton 238* (DUL); E edge of road in moist soil, Hugo Ave., Duluth, SE1/4 NE1/4 Sec. 20, T50N R14W, 12 Sept 1993, *Walton 1103* (DUL, MIN).

SPERGULARIA RUBRA (L.) J. & C. Presl. (Caryophyllaceae). Sand Spurry.

Previous knowledge. Spergularia rubra is an annual or short-lived perennial native to Europe and Asia in sandy soils (Komarov 1936, Tutin et al. 1993). It has been reported from Canada (Scoggan 1978b), from Alaska to California, and from Maine west to Wisconsin (Gleason & Cronquist 1991). Fassett (1976) considered it to be a rare roadside weed in north-central Wisconsin. Specimens of *S. rubra* at WIS are from the following counties: Ashland, Bayfield, Florence, Forest, Lincoln, Oneida, Price, Rusk, Sawyer, Shawano, Taylor, and Vilas. It was observed in Washburn County in 1995 (Walton, pers. observ.). *S. rubra* has been reported from Minnesota, but thought not to persist (Ownbey & Morley 1991).

Significance. It appears that *S. rubra* has established itself in at least four different localities in Duluth. Other northeastern Minnesota sites where *S. rubra* has been seen or collected include Angora, Peyla, and Fairbanks (St. Louis County), Knife River and Illgen City (Lake County), Barnum and Skelton (Carlton County). Typically, *S. rubra* was found on sandy roadsides with little competing vegetation. At Angora *S. rubra* was found in a damp depression near an abandoned sand pit along a one-lane logging trail, about 1.5 km from the main road, Hwy. 22. *S. rubra* was not found elsewhere on the logging road or on the nearby highway. Large numbers of *S. rubra* plants were seen at the four Duluth sites and the Knife River site. One of the Duluth populations (Robin Avenue) has persisted for at least 4 years. In this population there are some individuals that have survived for two seasons by resprouting from basal buds. It appears that this species is persisting in northeastern Minnesota.

MINNESOTA. ST. LOUIS CO.: in sandy shoulder along both sides of Robin Ave., Duluth, NE1/4 NW1/4 Sec. 20, T50N R14W, 25 Oct 1992, *Walton 242* (DUL); in sandy shoulder along recently straightened portion of Hwy. 77 on N side, Peyla, Sec. 4, T61N R16W, 18 Sept 1994, *Walton 1579* (DUL); moist sandy soil along E side of Forest Road 418, Sec. 10, T57N R12W, 26 Aug 1995, *Walton 1852* (DUL, MIN); LAKE CO.: occasional in sand/gravel of roadside ditch, near junction of Hwy. 61 and Hwy. 1, Illgen City, NE1/4 SW1/4 Sec. 11, T56N R7W, 15 Sept 1991, *Monson 6430* (DUL, MIN); CARLTON CO.: in sandy ditch spoils, S side of Gilbert Road, Skelton, NW1/4 NW1/4 Sec. 25, T47N R18W, 3 Sept 1993, *Walton 1056* (DUL).

CLEMATIS TERNIFLORA DC. (Ranunculaceae). Yam-leaved Clematis.

Previous knowledge. Clematis terniflora is a native of Japan (Ohwi 1965) grown as an ornamental in many parts of the United States, and frequently escaping from cultivation (Gleason & Cronquist 1991). Seymour (1989) reported it as rare along roadsides in New England. We are not aware of previous records for it outside of cultivation in the upper Great Lakes region.

Significance. This is apparently the first record outside of cultivation in Minnesota. It appears that an original colony established itself on a waste pile behind a former commercial greenhouse, then spread into a disturbed wetland about 250 m away. Here *C. terniflora* was growing among *Phalaris arundinacea* and *Calamagrostis canadensis*, climbing on a *Salix discolor*. These vines

were observed to produce many seeds, giving the species the potential to become more widely established in this area.

MINNESOTA. ST. LOUIS CO.: wooded area just W of Hugo Ave., Duluth, NE1/4 NE1/4 Sec. 20, T50N R14W, 12 Sept 1993, *Walton 1102* (DUL); 10 Jul 1995, *Walton 1730* (DUL, MIN).

SEDUM KAMTSCHATICUM Fischer. (Crassulaceae). Orange Stonecrop.

Previous knowledge. Sedum kamtschaticum is a native of eastern Asia and is cultivated as an ornamental. It escapes minimally, if at all, in North America (Clausen 1975), and has not been reported outside of cultivation in Minnesota or elsewhere in the upper Great Lakes region.

Significance. This species appears to have spread from original plantings within a former residential lot in Duluth from which the dwelling was removed in 1973; there has been no subsequent maintenance of the vegetation on this property. This is in an area with very steep slopes and frequent outcrops of igneous bedrock. *S. kamtschaticum* grows on the outcrops and appears to have spread into what were formerly adjoining areas of lawn. Only minor amounts of *S. kamtschaticum* appear on neighboring unmaintained properties, suggesting that the species has a poor ability to spread longer distances. This is evidence that this species may maintain itself for an extended period in Minnesota, but supports the perspective of Clausen (1975) that full naturalization is questionable.

MINNESOTA. ST. LOUIS CO.: formerly residential site above 5th St. at 6th Ave. W, Duluth, Sec. 27 & 28, T50N R14W, 20 Jul 1995, *Schimpf 250* (DUL, MIN).

SENECIO VISCOSUS L. (Asteraceae). Sticky Ragwort or Groundsel.

Previous knowledge. Senecio viscosus is a native of Europe (Tutin et al. 1976) now well established in waste places and railroad yards from Quebec to New Jersey (Gleason & Cronquist 1991), and across southern Canada from Nova Scotia to British Columbia (Scoggan 1978b). It has not been previously reported for Minnesota, Wisconsin, or Michigan. The nearest known populations date from 1972 (*Garton 15227 & 15277* LKHD) at Thunder Bay, Ontario; the species has also been collected just southeast of Sault Ste. Marie, Ontario (Voss 1996).

Significance. These are the first collections for Minnesota or Wisconsin. *Senecio viscosus* occurs sporadically throughout a primarily industrial and commercial strip about 20 km long near the St. Louis River and Lake Superior in Duluth, and in similar settings across the river in Superior, Wisconsin. We have not found it elsewhere in the area. It was first collected in Duluth in 1977, but not identified until 1993. The present distribution suggests that the species may have entered through the extensive rail or ship traffic of these ports.

MINNESOTA. ST. LOUIS CO.: railroad tracks near the St. Louis River, Duluth, Sec. 23, T49N R15W, 8 Sept 1977, *Lounsbury 9/8/77-24* (DUL); between sidewalk and retaining wall at 6th Ave. W and 5th St. on N side of street, Duluth, NW1/4 SW1/4 Sec. 27, T50N R14W, 4 Oct 1992, *Walton 239* (DUL); in waste area on Rice's Point, Duluth, SW1/4 Sec. 3, T49N R14W, 12 Sept 1994, *Walton 1572* (MIN).

WISCONSIN. DOUGLAS CO.: weed in shrub planting in front of Superior Municipal Library, NE1/4 NE1/4 Sec. 22, T49N R14W, 11 Sept 1995, *Walton 1901* (WIS); growing in ballast of railroad yard between Tower Ave. and Hammond Ave., Superior, NE1/4 NW1/4 Sec. 34, T49N R14W, 14 Sept 1995, *Walton 1906* (WIS).

LEONTODON AUTUMNALIS L. (Asteraceae). Fall Dandelion.
L. AUTUMNALIS var. *AUTUMNALIS*
L. AUTUMNALIS var. *PRATENSIS* (Less.) Koch

Previous knowledge. Leontodon autumnalis, native to Eurasia (Tutin et al. 1976), is sparsely established in interior North America and has not been reported previously from Minnesota. The nearest known populations are at Kenton, Houghton Co., Michigan, *Schimpf 262* (MICH, MSC) and the Lake Nipigon area, northwestern Ontario, *Garton 21531, 21533, 22973, 23085* (LKHD).

Significance. Leontodon autumnalis var. *autumnalis* was collected from an island in the St. Louis River at the extreme southern tip of Duluth in 1977, but not identified until 1995. It was then found to be abundant and widespread in turf on the Minnesota mainland in this vicinity, suggesting that the population may have become established several years ago. The species becomes progressively less common northeastward in the city of Duluth, and has not been observed in its northeastern third. Seed maturation was widely observed, and with its plumose pappus further local spread of the species may be expected. On both ends of this local range *L. autumnalis* var. *pratensis* was also collected within the populations; this variety is far less common than the typical one.

L. autumnalis var. *autumnalis*
MINNESOTA. ST. LOUIS CO.: Bear Island, St. Louis River, Duluth, Sec. 11, T48N R15W, 9 Sept 1977, *Lounsbury 9/9/77-2* (DUL); turf between campground and railroad E of parking for boat launch, Duluth, Sec. 10, T48N R15W, 11 Aug 1995, *Schimpf 253* (DUL, MIN).

L. autumnalis var. *pratensis*
MINNESOTA. ST. LOUIS CO.: waste ground N of Central Entrance & W of Kissell Ave., Duluth, west-central edge of Sec. 21, T50N R14W, ligules pale yellow, lacking typical reddish stripe beneath, 12 Aug 1995, *Schimpf 254* (DUL); turf of low ground, SW intersection McCuen St. & 96th Ave. W, Duluth, Sec. 10, T48N R15W, 23 Aug 1995, *Schimpf 256* (DUL).

SPARGANIUM GLOMERATUM Laest. (Sparganiaceae). Clustered Bur-reed.

Previous knowledge. Until 1993 *Sparganium glomeratum* was known in the United States only from nine sites in Minnesota. It was also reported from British Columbia, Saskatchewan, Yukon, Alberta, Quebec, and Newfoundland (Scoggan 1978a, Brayshaw 1985). The major center of distribution for the species is Eurasia (Cook & Nicholls 1986).

Significance. The collections of this rare circumboreal species reported here extend its range southeastward in the United States, and include the first records for Wisconsin.

Diagnostic characters. The fruiting stems of *Sparganium glomeratum* are erect, measuring around 30 cm tall, and are terminated by a simple inflorescence bearing (1) 3-5 (7) densely crowded, mostly sessile, supra-axillary, pistil-

late heads 0.3-1.2 cm across. The pistillate heads subtend 1, or 2 crowded, staminate heads located at the shoot apex above a very short (<0.5 mm) internode. The leaves of *S. glomeratum* are erect, rarely floating; those of the inflorescence are inflated at the base and sharply keeled, and most of them exceed the flowering portion of the stem. The achenes are fusiform with an obconic base, sometimes slightly constricted just above the middle, and are about 3-5 mm long, the surface shiny green or brown, occasionally with red dots. The beak of the achene is short (ca. 1.5 mm). The stigma measures about 0.5 mm. The perianth segments are about 1/3-1/2 the length of the achene.

WISCONSIN. DOUGLAS CO.: sedge marsh (*Carex lacustris* and other graminoids) in a willow/alder swamp, Superior, NW1/4 NW1/4 Sec. 35, T49N R14W, 30 Sept 1993, *Monson 6585* (DUL, WIS); with *Sparganium chlorocarpum* in soil and muddy shallow water at base of a beaver dam on Bergen Creek, Wascott, SW1/4 NE1/4 SE1/4 Sec. 25, T43N R12W, W side of Hwy. 53, 25 Jul 1995, *Walton 1761* (DUL); shallow, marshy pool in aspen/birch/fir/white pine forest about 1 mile north of Gordon, NE1/4 NE1/4 Sec. 36, T44N R12W, 26 Jul 1995, *Walton 1764* (DUL); shallow water at the edge of a beaver pond in aspen forest with some conifers, Parkland, NE1/4 NW1/4 Sec. 24, T48N R13W, 27 Sept 1995, *Walton 1925* (DUL). WASHBURN CO.: flooded conifer/hardwood swamp, now a floating cattail marsh, W side of Hwy. 53, NE1/4 NE1/4 SE1/4 Sec. 11, T42N R12W, 25 Jul 1995, *Walton 1756* (WIS); in shallow water near margin of conifer/hardwood swamp about 50 m west of Hwy. 53, NE1/4 SE1/4 SE1/4 Sec. 11, T42N R12W, 25 Jul 1995, *Walton 1758* (MICH).

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OBITUARY
JAMES A. WEBER (1944–1998)

Dr. James A. Weber, formerly of the University of Michigan Biological Station, died of a heart attack while riding his bicycle home from work on 7 January, 1998.

Born 16 March, 1944, to Leo and W. Kathleen (Lewis) Weber in Santa Monica, California, he earned an Associate of Arts degree at El Camino Community College, then went on to the University of California at Berkeley, where he majored in Botany and earned his B.A. in 1966. At the University of Michigan, he earned a M.A. in 1967 and a Ph.D. in 1973.

On 18 April, 1970 he married Nancy Jane Smith (daughter of Alex Smith) in Ann Arbor. Jim assisted Nancy with some of her mycological work, contributing some of the photographs for the revised edition of the very popular book *The Mushroom Hunter's Field Guide* (by Alexander H. Smith and Nancy Smith Weber, University of Michigan Press, 1980). From 1984 to 1989 Jim and Nancy were co-editors of *The Michigan Botanist.*

From 1973 to 1988 he worked in various capacities in botanical research for the University of Michigan Biological Station. His work there in physiological plant ecology with station director Dr. David M. Gates ushered in the current era of such high-tech research at the Station. In September 1988, Jim moved to the Environmental Protection Agency laboratory in Corvallis, Oregon, as a Research Plant Physiologist. There he participated in research on the effects of tropospheric ozone (smog) on crop and forest ecosystems. His research contributed significantly to recent changes in the National Ambient Air Quality Standard for tropospheric ozone. During his work at EPA, Jim published many research papers and two book chapters. Dr. Weber also held a courtesy faculty position in the Department of Botany and Plant Pathology at Oregon State University.

Contributions in Jim's memory may be made to: the Greenbelt Land Trust, Inc., (P.O. Box 1721, Corvallis, OR 97339), the American Indian College Fund (21 West 68th Street, Suite 1F, New York, NY 10023), the University of Michigan Biological Station Student Fund (1111 Natural Science Bldg., Ann Arbor, MI 48109-1048), or the League of American Bicyclists (1612 K Street, NW, Suite 401, Washington, DC 20006).

——Barbara J. Madsen

THE OCCURRENCE OF THE FRESHWATER BROWN ALGA *SPHACELARIA FLUVIATILIS* JAO FROM MICHIGAN

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INTRODUCTION

There are only seven genera of brown algae (Phaeophyceae) living in freshwater habitats. The knowledge of their distribution has been limited for a long time. The most conspicuous are the dark brown crusts of *Heribaudiella fluviatilis* (Aresch.) Sved. covering stones and rocks of rivers and streams. Such crustaceous brown algae are known from Germany (Budde 1927, Wehrle 1942), England (Fritsch 1929), Scandinavia (Israelson 1938, Waern 1938, 1949), Latvia (Skuja 1925, 1928), Japan (Yoshizaki et al. 1984), western Canada (Wehr & Stein 1985), and Austria (Kusel-Fetzmann 1996). A similar encrusting phaeophyte, the genus *Pleurocladia*, has also recently been reported for the United States (Ekenstam et al. 1996).

The distribution of members of the freshwater Phaeophyceae is very poorly known. Of the more than 250 genera and 1500 species, only seven are known from freshwater environments (Bold & Wynne 1985, Bourrelly 1981, Smith 1950). Of these seven genera, six belong to the order Ectocarpales (West & Kraft 1996). The remaining genus, *Sphacelaria*, belongs to the order Sphacelariales. Similar to species of freshwater Rhodophyceae, the freshwater brown algae generally occur in running waters. It has been suggested and demonstrated in some instances, that some freshwater Rhodophyceae and Phaeophyceae colonized freshwater habitats by invasion from marine environments (Geissler 1983, Israelson 1938, Lin & Blum 1977, Skuja 1928).

This paper reports the occurrence of *Sphacelaria fluviatilis* Jao in Michigan, a species first described from China (Jao 1943); previous reports for Michigan were in the form of abstracts (Thompson 1975, Timpano 1978).

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[1]Deceased 3 June 1980
[2]Deceased 24 April 1987.

METHODS AND MATERIALS

Samples were collected from stones and coarse gravel along the shore of Gull Lake, Kalamazoo County, Michigan State University's Biological Station. The initial collection was made by RHT in July 1968. Subsequently, it was collected in September 1968, July 1969, and again in August 1977. Samples of this delicate brown alga were obtained by scraping the thallus free from the rock substrate. The alga never occurred in large quantities. Attempts to maintain cultures for extended periods failed.

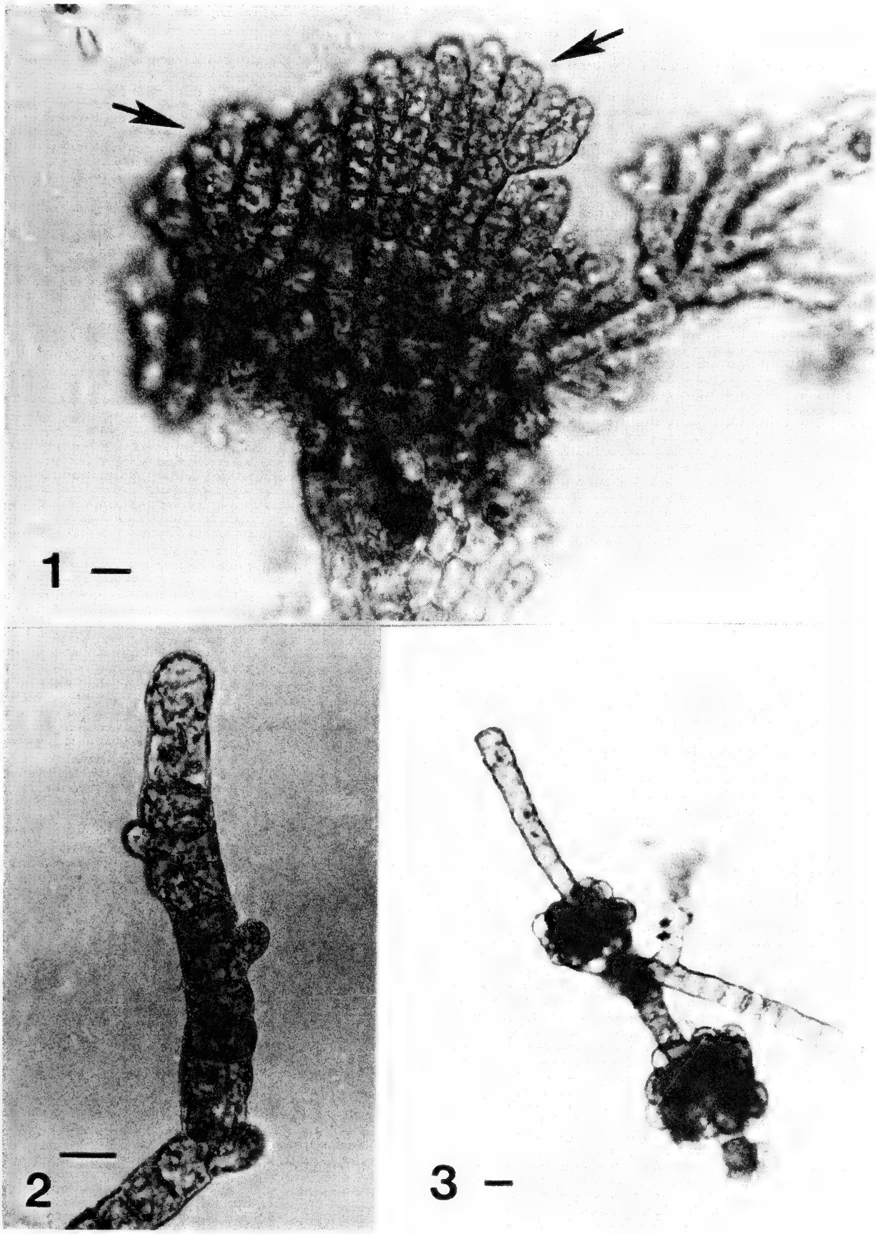
RESULTS AND DISCUSSION

Sphacelaria fluviatilis Jao was detected because curious pale patches were observed on the surface of small, subaerial rocks. The gelatinous matrix surrounding the cells of *Sphacelaria* was a reservoir of algae, fungi, and bacteria. The algal cohorts were small *Chroococcus*-like cyanobacteria and *Chlorococcum*-like chlorophytes.

The brown alga had a heterotrichous growth habit. The prostrate system was limited and composed of a few branched filaments. Both the prostrate and erect filaments were pseudoparenchymatous (Figs. 1-3). The erect axes frequently possessed well-developed lateral branches. The apical cell with a dense-appearing cytoplasm was large in comparison to the other cells of the filament (Fig. 2). All apical divisions gave rise to subtending segments of the filament, never to branches. No corticating filament cells or hairs were observed. The only presumed reproductive structures noted were clusters of globose cells termed propagula (Fig. 3). Similar reproductive structures were also observed by Jao (1943, his fig. 1, i & j). No flagellated cells were observed.

Gull Lake is an artificial body of water. Its substratum is glacial till. Although the lake is mildly eutrophic (Moss 1972a,b), the type collection site is near a duck-feeding station (Jao 1943). The Michigan site is partially shaded by overhanging trees. The alga was collected to a depth of one meter. The phaeophyte was always observed to be growing at the rock-mud interface, appearing as small circular or irregularly shaped brown patches, which could be easily confused with benthic diatoms.

Only one other freshwater brown alga, *Sphacelaria lacustris* Schlosser & Blum has been reported for the Great Lakes region (Schlosser & Blum 1980). This alga was originally described from collections along the western shoreline of Lake Michigan. It differs from *S. fluviatilis* in having erect filaments of less than 1 mm in both culture and field material. It further differs in lacking 1) the typically opposite branching, 2) multicellular hairs, and 3) the dissimilar structure of the vegetative propagules found in our material. The collection of *S. fluviatilis* from Michigan demonstrates the need for more critical study of epilithic algae within rocky littoral zones of lakes or near running water, as well as the importance of consulting published floras from other countries. The authors believe knowledge of *S. fluviatilis* biogeography is incomplete, although it is possible that the species may have a disjunct distribution.



FIGURES 1–3. *Sphacelaria fluviatilis.* 1. Pseudoparenchymatous growth (arrows). 2. Section of an erect filament exhibiting the apical growth characteristic of the Sphacelariales. 3. Propagating cells in clusters on the erect axes. Scale bars = 10 µm.

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THE ASTERACEAE OF OHIO—MISSED RECORDS

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ABSTRACT

One hundred twelve county records are added to Ohio's Asteraceae distributional listings. Use of the Herbarium of Youngstown State University (YUO) expands the floristic record with 75 taxa in 36 genera that were missed in Fisher's publication.

INTRODUCTION

The Herbarium of Youngstown State University (YUO), although founded in 1965 and currently the fourth largest in Ohio with 65,246 specimens, has been under-utilized by investigators. An example of this was in the preparation of *The Asteraceae of Ohio* (Fisher 1988). This paper presents the data not included in that publication.

MATERIALS AND METHODS

We examined all the specimens of Asteraceae that were in YUO before 1988 to determine the distribution records that were missed by that publication.

RESULTS

The missed distribution records presented in Table 1 are in the same taxonomic arrangement and with the same nomenclature used by Fisher (1988). In addition to the scientific name, the county and date(s) of collection are provided. Although we picked 1988 as the cut-off date, if we had picked 1987, only one record would have not been included in the table. If we had picked 1986, *Senecio vulgaris* L. from Seneca Co. would still have been the only record not to appear in the table. If we had picked 1985, *Tussilago farfara* L. from Vinton Co. would have been the only additional record not to appear in the table.

As shown, 112 county records were missed. One state record, *Petasites hybridus* (L.) Gaertn., Mey. and Scherb., was only given a notice based upon the letters the senior author had written Dr. Fisher. Had Fisher visited YUO or borrowed specimens, he would have also discovered the sterile specimen from Ashland County which was in YUO at that time. That station was still there when the senior author collected a fertile specimen in 1994.

Dr. Fisher treated *Leontodon leysseri* (Wallr.) G. Peck in a note in the text of

TABLE 1.

Species	County	Year Collected
Vernonia gigantea (Walt.) Trel.	Portage	1982
	Warren	1973
Vernonia missurica Raf.	Mahoning	1973
Eupatorium coelestinum L.	Hocking	1966
	Jackson	1971, 1980
	Noble	1974, 1987
	Richland	1980
Eupatorium fistulosum Barratt	Belmont	1982
	Jackson	1971
Eupatorium purpureum L.	Mahoning	1966, 1973, 1980
Eupatorium rugosum Houtt.	Noble	1978
Eupatorium sessilifolium L.	Noble	1978
	Ashland	1982
Liatris spicata (L.) Willd.	Columbiana	1978, 1979
	Stark	1915
Liatris squarrosa (L.) Michx.	Highland	1971
Solidago bicolor L.	Noble	1980
Solidago rugosa Mill. var. *aspera* (Ait.) Fern.	Noble	1978
Solidago squarrosa Muhl.	Mahoning	1944
Aster drummondii Lindl.	Mahoning	1935
Aster ericoides L.	Cuyahoga	1890
Aster lateriflorus (L.) Britt	Noble	1980
Aster lowrieanus T.C. Porter	Mahoning	1931, 1935
	Noble	1980
Aster patens Ait. var. *phlogifolius* (Muhl.) Nees	Scioto	1974
Aster prenanthoides Muhl.	Cuyahoga	1890
Aster shortii Lindl.	Columbiana	1982
	Cuyahoga	1890
Aster vimineus Lam.	Carroll	1979
Erigeron annuus (L.) Pers.	Cuyahoga	1890
	Van Wert	1981
Gnaphalium purpureum L.	Columbiana	1979
	Cuyahoga	1890
Gnaphalium uliginosum L.	Mahoning	1892
Gnaphalium viscosum H.B.K.	Trumbull	1930
	Mahoning	1910
	Columbiana	1892
Ambrosia artemisiifolia L.	Ashtabula	1966
	Belmont	1982, 1983
	Carroll	1982
Xanthium strumarium L. var. *canadense* (Mill.) T. & G.	Gallia	1979
	Madison	1980
	Seneca	1979
Polymnia canadensis L.	Noble	1980
Silphium perfoliatum L.	Belmont	1983
Rudbeckia triloba L.	Trumbull	1981
Verbesina alternifolia (L.) Britt.	Williams	1984
Verbesina occidentalis (L.) Walt.	Noble	1978, 1980
Coreopsis tripteris L.	Ashland	1982
Bidens frondosa L.	Noble	1978
Bidens vulgata Greene	Adams	1980
Galinsoga parviflora Cav.	Mahoning	1967
Helenium flexuosum Raf.	Mahoning	1934
	Adams	1980
Athemis arvensis L.	Pike	1970
Chrysanthemum leucanthemum L.	Clermont	1981

TABLE 1. Continued

Species	County	Year Collected
Chrysanthemum parthenium (L.) Bernh.	Mahoning	1935
	Pickaway	1975
Artemisia absinthium L.	Mahoning	1935
Artemisia annua L.	Adams	1980
	Mahoning	1909
Artemisia biennis Willd.	Mahoning	1915
Artemisia pontica L.	Trumbull	1944
Tussilago farfara (L.)	Athens	1980, 1982
	Richland	1979
	Vinton	1985
Petasites hybridus (L.) Gaertn., Mey. & Scherb.	Ashland	1982
Cacalia suaveoleus L.	Columbiana	1969
Senecio aureus L.	Tuscarawas	1978
Senecio obovatus Muhl. ex Willd.	Noble	1968
Senecio sylvaticus L.	Mahoning	1934
Senecio vulgaris L.	Mahoning	1970
	Seneca	1987
Arctium lappa L.	Columbiana	1983
Arctium minus Schkuhr.	Williams	1984
Cirsium arvense (L.) Scop.	Columbiana	1972, 1977, 1979, 1980
Cirsium discolor (Muhl.) Spreng	Adams	1980
	Noble	1974
	Richland	1980
Cirsium muticum Michx.	Adams	1980
Cirsium pumilum (Nutt.) Spreng.	Belmont	1982
	Mahoning	1934
Cirsium vulgare (Savi) Tenore	Belmont	1974
	Carroll	1974
	Harrison	1974
Centaurea maculosa Lam.	Jefferson	1982
	Trumbull	1915
Centaurea nigra L.	Mahoning	1933, 1979
Lapsana communis L.	Mahoning	1934
Hypochaeris radicata L.	Carroll	1979
	Columbiana	1982
	Mahoning	1929
	Tuscarawas	1978
Leontodon leysseri (Wallr.) G. Beck	Portage	1982
Tragopogon porrifolius L.	Hardin	1982
Taraxacum laevigatum (Willd.) DC.	Mahoning	1943
Sonchus asper (L.) Hill	Noble	1978
	Highland	1973
Sonchus oleraceus L.	Columbiana	1978
	Mahoning	1915, 1935, 1978,1982
	Trumbull	1974
Lactuca biennis (Moench) Fern.	Ashtabula	1965
Lactuca canadensis L.	Columbiana	1978, 1979, 1981
	Cuyahoga	1891
	Noble	1980
Lactuca floridana (L.) Gaertn. var. *floridana*	Mahoning	1968
Lactuca saligna L.	Trumbull	1981
Prenanthes altissima L.	Adams	1980
Prenanthes crepidinea Michx.	Trumbull	1981
Hieracium pilosella L.	Ashtabula	1977
Hieracium scabrum Michx.	Columbiana	1969, 1979, 1980
Hieracium venosum L.	Jefferson	1979

the generic description saying even though two specimens were seen at KE, its existence in the present day Ohio flora is doubtful. Again, an examination of YUO would have verified an additional specimen.

DISCUSSION

In 1988 the long-awaited volume on the Asteraceae of the flora of Ohio was published. In the Introduction, the author states that the flora and accompanying county dot maps are based upon specimens examined at the herbaria of The Ohio State University (OS), Miami University (MU), University of Cincinnati (CINC), Kent State University (KE), Ohio University (BHO), Bowling Green State University (BGSU), and several smaller ones (Fisher 1988 p.1).

While it would not be expected that all the specimens of the 37 herbaria in Ohio (Cusick & Snider 1982) would be examined, it would seem logical that large or important collections of specimens would be examined. Despite several personal invitations to visit the Herbarium of Youngstown State University (YUO), which in 1982 was the 6th largest in Ohio and the only one to have specimens of *Petasites hybridus* (Chuey 1983), Dr. Fisher neither used the facilities of YUO nor asked for a loan of any specimens.

In the review of *The Asteraceae of Ohio* by Ronald Stuckey in the Ohio Journal of Science (1993), which covered many of the aspects of the book, no mention was made of this incomplete examination of the herbaria in Ohio. Also in 1993, Barbara L. Wilson in a paper about the Herbarium of the University of Nebraska at Omaha showed that with only 25,500 specimens, OMA (Holmgren et al. 1990), a small herbarium, was an important source of Iowa flora records.

In contrast, Dr. Cooperrider, beginning in 1985, requested numerous loans from YUO for the Linaceae through Campanulaceae volume of The Ohio Flora he authored (1995). These loans resulted in at least 169 county records (Cooperrider, pers. comm.).

The 112 county records from 32 different counties that this paper presents clearly indicate that anyone working on the Flora of Ohio needs to make use of YUO.

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Chuey, C. F. 1983. *Petasites hybridus* in Ohio. Laitsch-Herb. Pub. of YSU 3:49–51.

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CALL FOR PAPERS

1998 MIDWESTERN RARE PLANT CONFERENCE
CHICAGO BOTANIC GARDEN, GLENCOE, IL
4-6 NOVEMBER, 1998

The 1998 Midwestern Rare Plant Conference, sponsored by the Chicago Botanic Garden and the Center for Plant Conservation, is intended to provide a forum for exchanging research results on rare Midwestern plants, for setting regional plant conservation priorities, and for developing and implementing collaborative plant conservation projects in the Midwest.

Anyone interested in presenting a paper or poster at this conference must submit an abstract to the Program Chair before 1 July, 1998. Papers, along with selected proceedings from the conference, will be considered for publication in the Annals of the Missouri Botanical Garden. Both research and stewardship projects involving rare Midwestern plants are appropriate, including presentations on population biology, demography, reproductive biology, systematics, autecology, genetics, surveying and monitoring, reintroductions, and recovery strategies. Papers will be 15 minutes in length, followed by 5 minutes for questions; posters will be 3 feet high by 6 feet wide.

For further information, contact Dr. Kayri Havens, Program Chair, Rare Plant Conference, Chicago Botanic Garden, 1000 Lake Cook Rd., Glencoe, IL 60022.

EDITORIAL NOTICES

ERRATA

In two of the "Big Trees" articles previously published in the Botanist, Linnaeus was wrongly given as the author of the Latin name for the species. The correct names and authors are *Fraxinus pennsylvanica* Marsh. (Mich. Bot. 34: 144-146) and *Quercus macrocarpa* Michx. (Mich. Bot. 35: 27–29).

PRODUCTION ERRATA

The March, 1996 issue of the Michigan Botanist (Vol. 35, No. 2) was incorrectly paginated. This issue should run from page 41 (outside front cover) to page 72 (table of contents). Instead it was begun with page 33. The only paper for which this creates any difficulty with unambiguous citation is the first paper in the issue, by Reznicek and Judziewicz. If you wish to cite this paper, the correct form is:

Reznicek, A.A., & E.J. Judziewicz, 1997 ("1996"), A new hybrid species, ×*Calammophila donhensonii* (*Ammophila breviligulata* × *Calamagrostis canadensis*, Poaceae), from Grand Island, Michigan, Mich. Bot. 35:35-40 *bis*.

You may have noticed another small problem with the March issue—the grey overprint of the Upper Great Lakes was missing from the journal logo. This was simply a printer's error; the grey overprint is added to the cover by the printer at the last stage of composition, so the omission could not be noticed by either the editor or the typesetter—we both see the cover at the proof stage without the lakes. Rest assured that the lakes are still here; they have not been drained or diverted to some desert state or removed by act of Congress.

LIST OF REVIEWERS

I wish to thank the following individuals, who reviewed papers for Volume 35. Their volunteer efforts make possible the continued high quality of the papers in this journal.

Paul Catling
Ted Cochrane
Garret Crow
Howard Crum
Stephen Darbyshire
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Robert Sheath
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Mike Wynne

The January issue (Volume 35, No. 1) was mailed May 7, 1997.
The March issue was mailed June 10, 1997.

CONTENTS

On the cover: *Hart's-tongue fern* (Phyllitis scolopendrium *(L.) Newman*) *on the Bruce Peninsula, Michigan Botanical Club Spring Foray, photographed by Bobbi Sabine, 24 May 1997.*